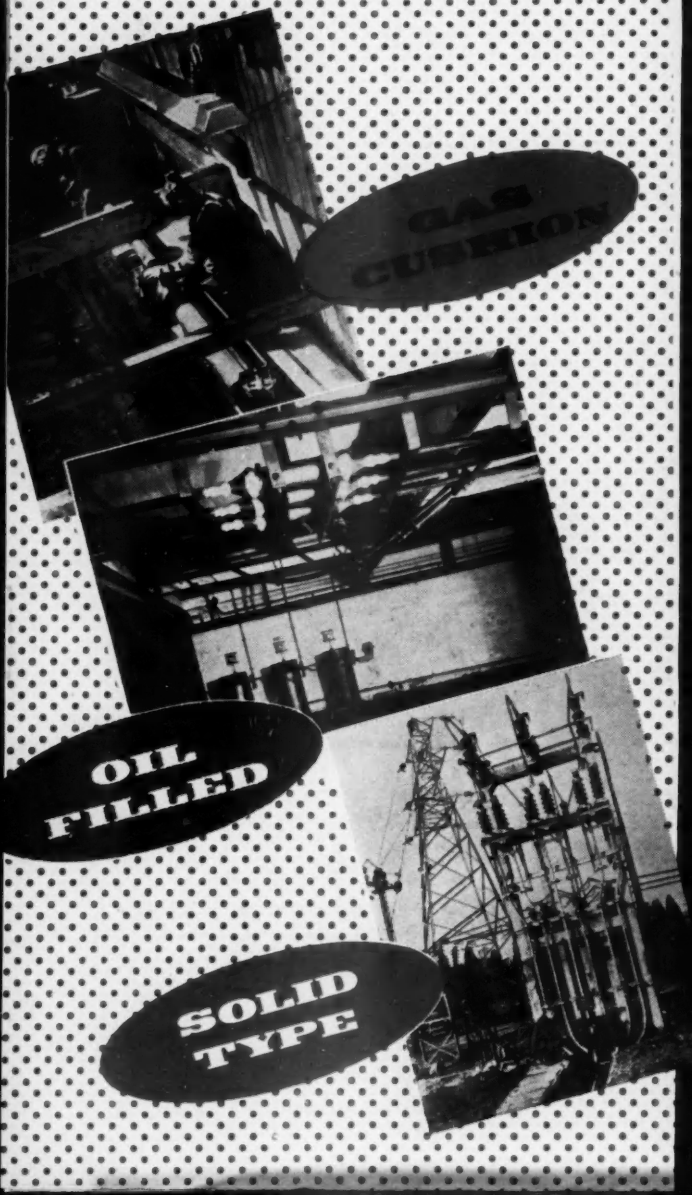
ELECTRICAL TIMES

THURSDAY
12 JULY
1951
NINEPENCE



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Specialists in Super-Tension Cable Technique

We are able to install complete super-tension schemes, including joints, terminations, etc., for all three of the principal underground cable systems: Gas Cushion, Oil Filled and Solid Type.

Illustrations show typical super-tension contracts carried out by HENLEY'S.

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MANUFACTURERS

W. T. HENLEY'S
TELEGRAPH WORKS CO. LTD.
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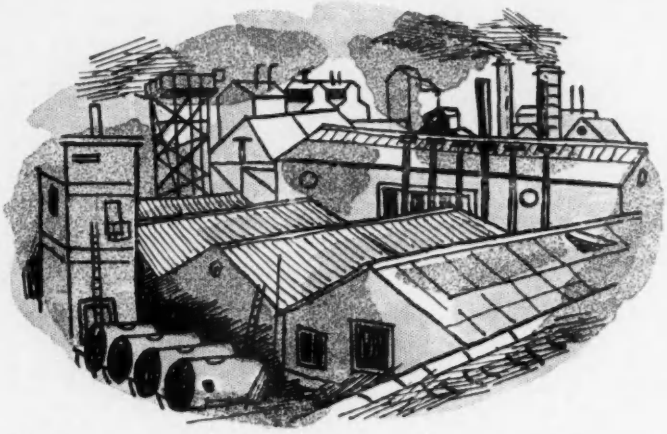


Progress through the Years

Fifty years ago we were making Micanite sheets at Stansted, Essex, in a small building and using some adjoining Tudor cottages for offices. We are still making Micanite sheets but on a vaster scale and in the course of the years we have added to our manufacturing activities Empire varnished insulating materials, Paxolin laminates, Panilax laminates and Panilax moulded resin and the production of High Voltage Bushings and Insulators. In addition to the main works at Walthamstow we have four other factories.

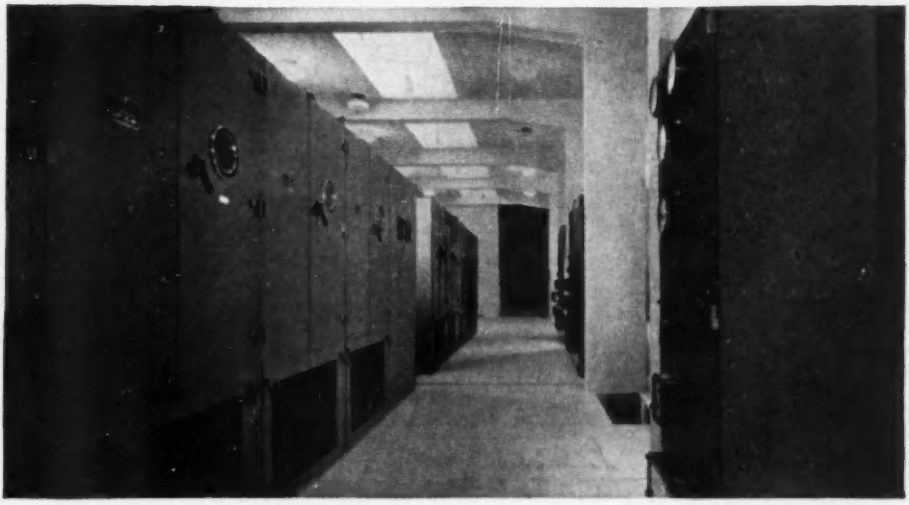
Electrical Insulation Engineering is our job and on our Fiftieth Birthday we look back with pride on our achievements through the years.

m and i *The Micanite and Insulators Company Limited*
Empire Works, Blackhorse Lane, Walthamstow, London, E.17

MANUFACTURERS OF MICANITE (BUILT-UP MICA INSULATION). FABRICATED AND PROCESSED MICA. PAXOLIN LAMINATED MATERIALS. PANILAX LAMINATED MATERIALS AND MOULDINGS. EMPIRE VARNISHED INSULATING CLOTHS AND TAPES. HIGH VOLTAGE BUSHINGS AND TERMINALS.

'ENGLISH ELECTRIC'

mercury-arc rectifiers



3,000 v. Pumpless Rectifiers in Traction Service

Electrification of the Brazilian Estrada de Ferro Santos a Jundiai was completed by 'English Electric' in 1950. Fifteen 3,000 h.p. 3,000 volts DC electric locomotives, the most powerful of their type yet built in Britain, three 3-car suburban trains, and all AC supply, transmission, signalling, converting and control equipment — including substation buildings — were supplied by the Company.

In this typical substation at Tiete, power is fed to the overhead conductors by two air-cooled, sealed steel-tank mercury-arc rectifier sets each rated 2,000 kW at 3,000 volts. Ultimate total capacity of the substations is 18,000 kW, of which 12,000 kW is installed, soon to be increased by a third 2,000 kW set at Tiete to meet increased traffic demands. This is believed to represent the first application of pumpless air-cooled steel-tank rectifiers for main line traction duty at 3,000 volts.

'English Electric' rectifier equipments in service range from the 36 kW unit for Istanbul University to a 27,810 kW installation for aluminium production, largest ever supplied by a British manufacturer.

The ENGLISH ELECTRIC Company Limited

QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Rectifier Substation Department : Stafford

Works: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL

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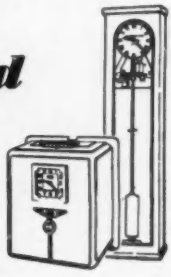

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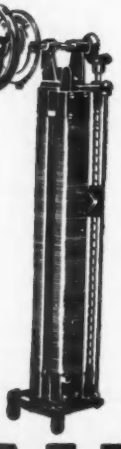

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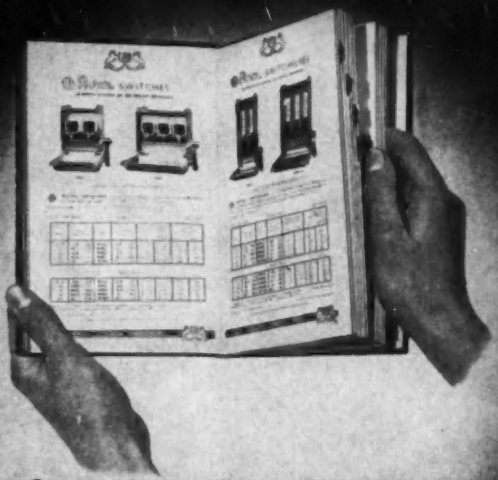

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His plot, however, didn't succeed, but not from lack of trying, and it's certainly not from lack of trying that we here can't make enough fires and cookers* to meet all your needs. So until we can make enough, please remember the guys at Enfield who are doing their best to see that you get your fair share.

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* *and Convectors, Space Heaters, Bed Warmers, Warming Cabinets and Drying Cabinets as well.*

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Rectangular Pin

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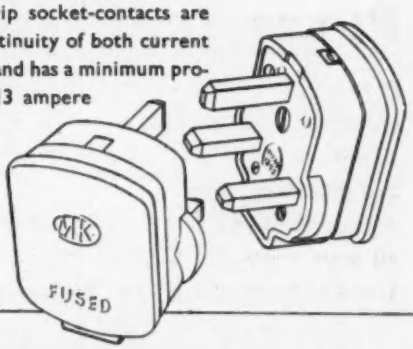

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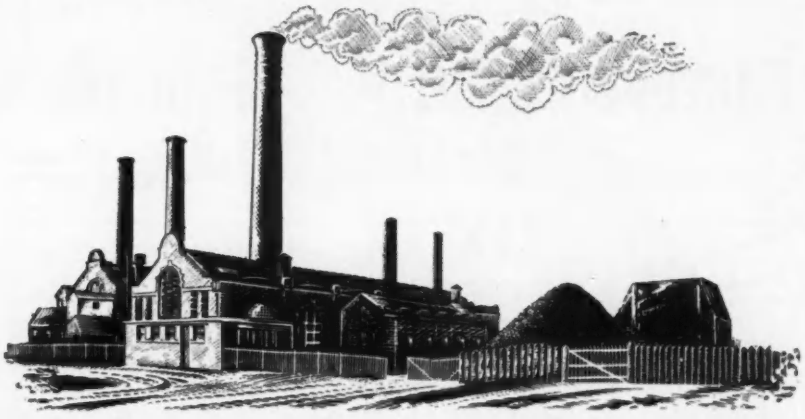
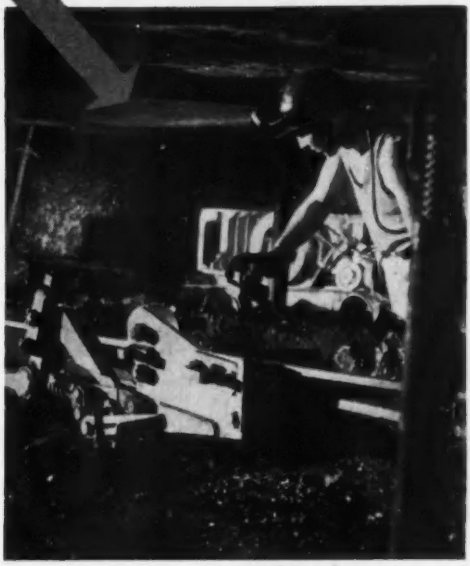
win the black diamonds



With dollar gaps and export battles, shortages and targets, labour problems and arguments at high-policy level—the coal has to be won from the pits day and night. And won in increasingly large quantities as consumption climbs steadily up. The miners play their part, with machines and electrical energy helping them in the battle for more coal. Our own mining equipment has been serving underground for many years. Metalclad oil-break switchgear, transportable sub-stations, flame-proof air-break switchgear, contactor, drill and lighting-transformer panels—helping win the black diamonds upon which the country's wealth depends.



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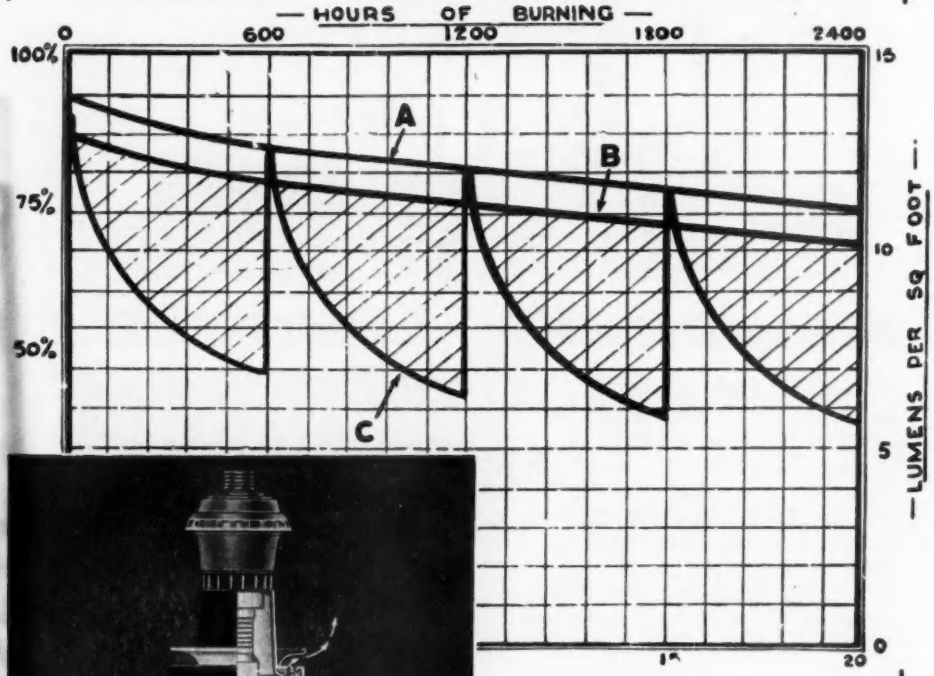

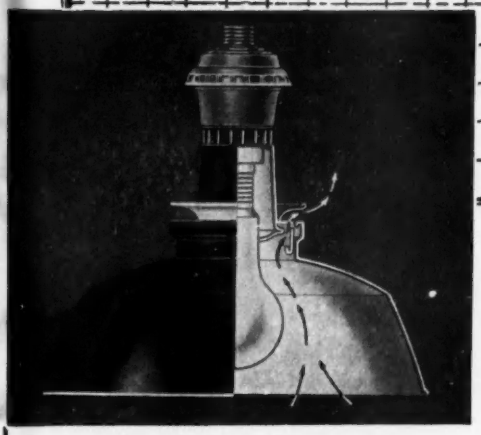

MAXLUME LIGHTING ENGINEERS will gladly explain the significance of the above curves to you. It may save you £.£.£s.

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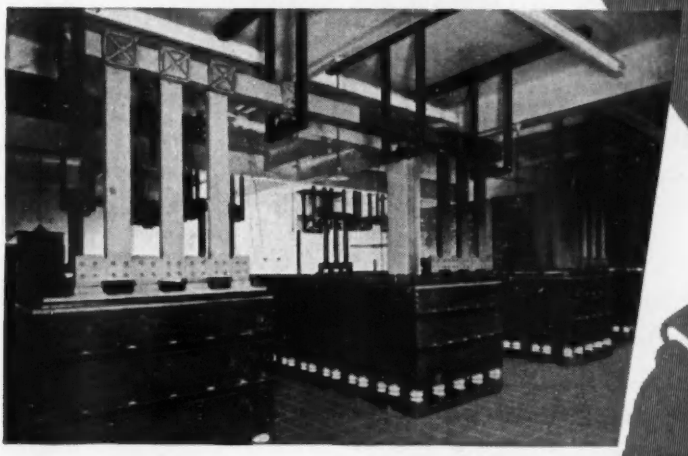
P & G BATTERIES in the public service



These batteries in the Museum Telephone Exchange, London, are typical of many P & G batteries installed throughout the country to maintain telephone efficiency. Our 60 years' experience in the battery business covers a vast and varied field; including batteries for generating stations, railway electrification work and emergency lighting systems. P & G 3 point service working on the sound principle of two heads being better than one, exists to provide: 1. *Detailed specifications or an impartial second opinion on any scheme.* 2. *Complete equipment and installation.* 3. *Regular inspection and report.*

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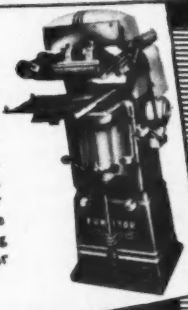

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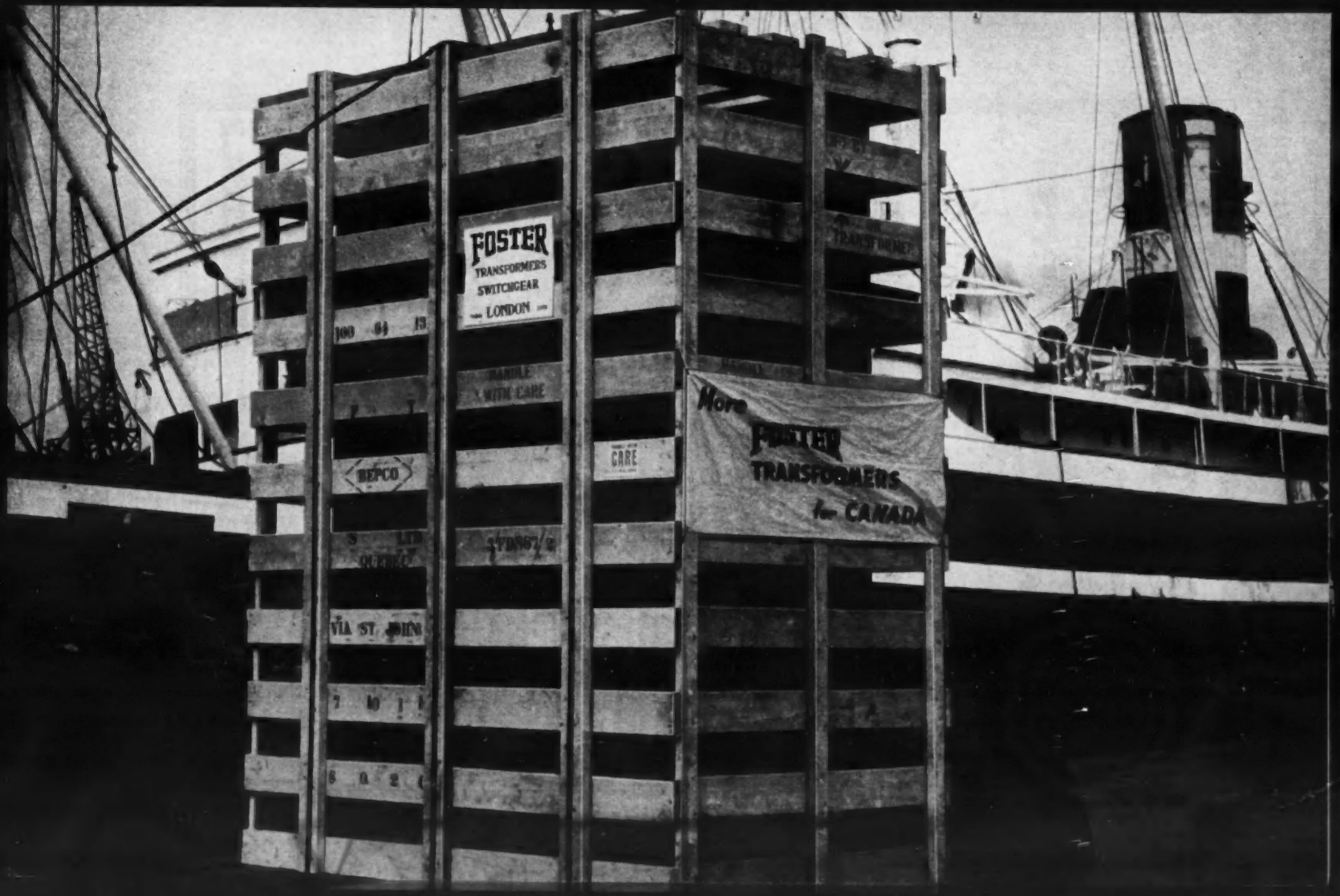
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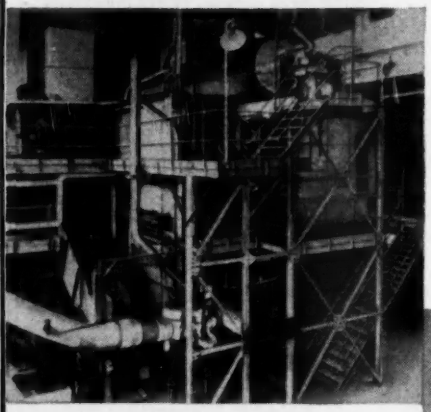

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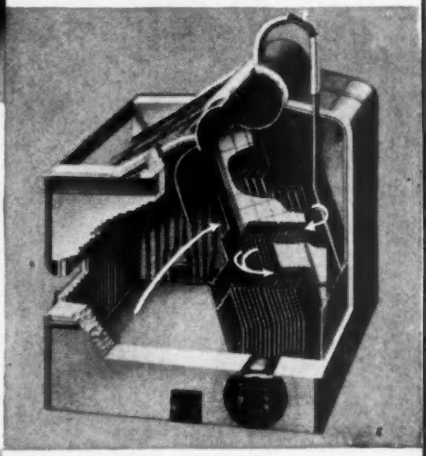
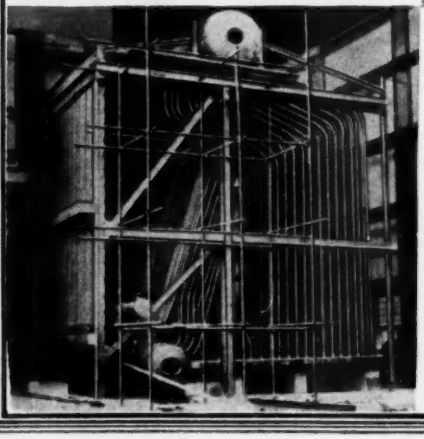
The illustrations show:

(above) *one of the integral furnace boilers at Wilton Works, I.C.I. Ltd.*

(below) *The boiler in course of erection.*

(centre) *Sectional view of integral furnace boiler with arrows showing gas passes.*





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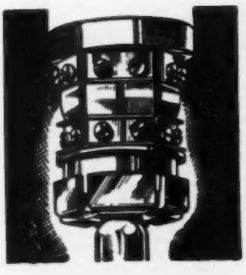

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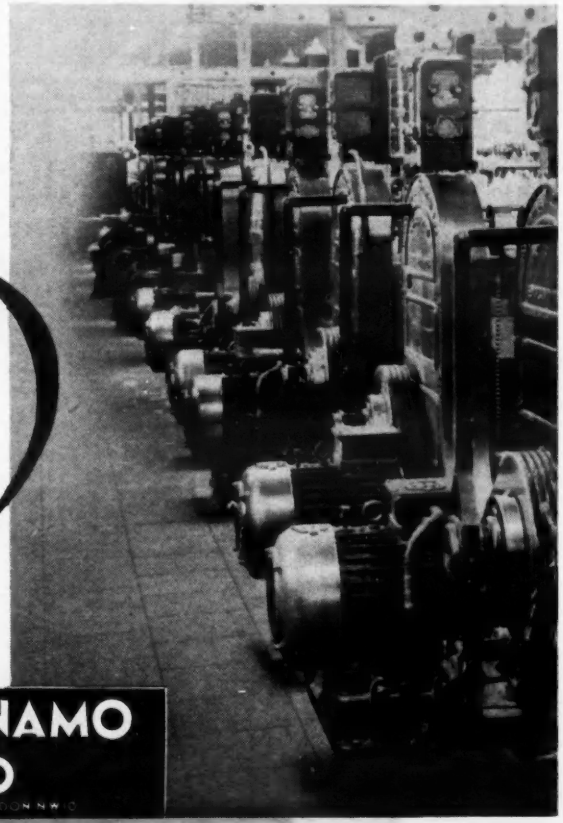

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High voltage air-blast circuit-breakers for outdoor service

Tested for breaking charging currents of long lines

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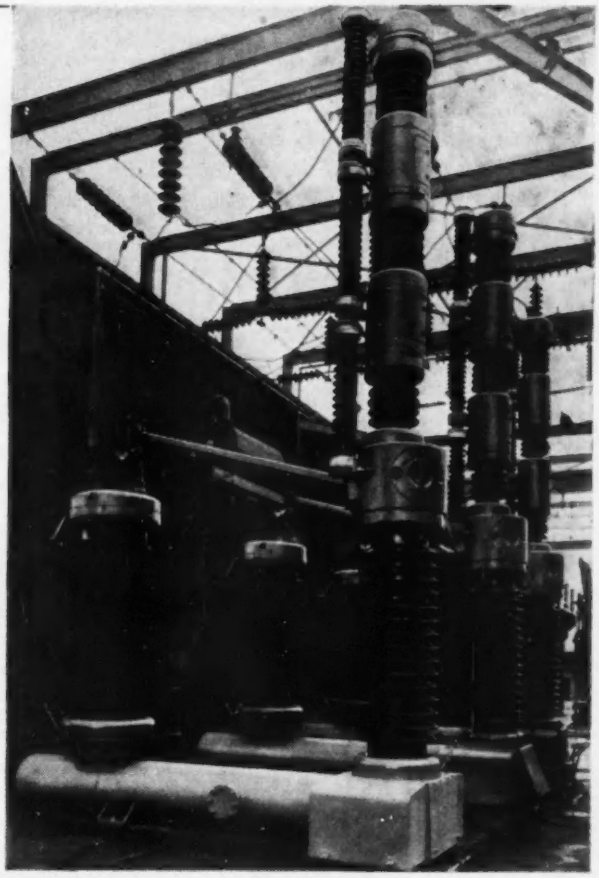

The ENGLISH ELECTRIC Company Limited

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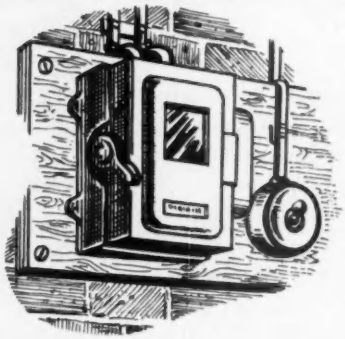

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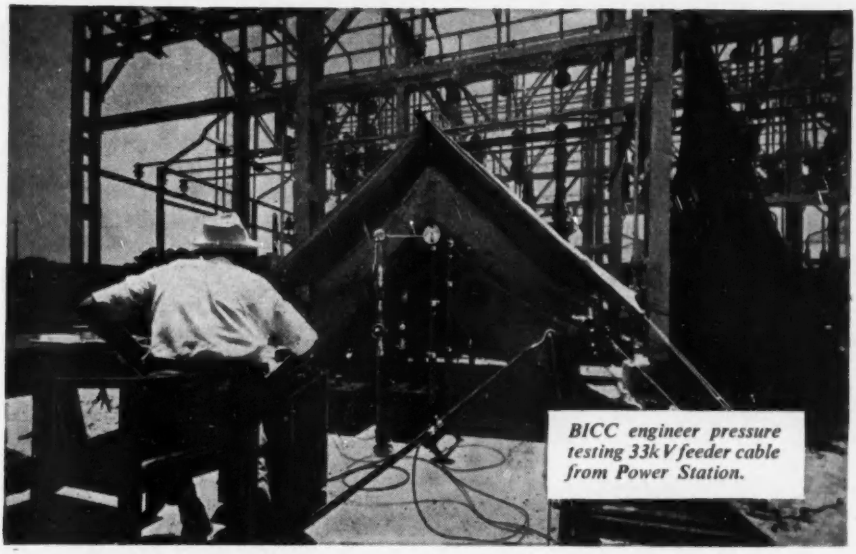


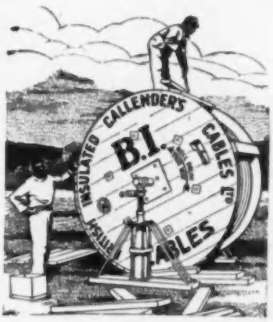
BICC engineer pressure testing 33kV feeder cable from Power Station.

FINAL MOVE in a 60 mile cabling job

The engineer above is pressure testing a 33kV cable . . . last move in the biggest cabling job of its kind ever undertaken in South Africa. Installed for the Electricity Supply Commission—Cape Western Undertaking, and completed in January 1951, this contract included the laying of 60 miles of 33kV cable. Four hundred joints were made, forty-four sealing ends fitted. Cables, joints and sealing ends were all supplied by BICC and installed under their supervision.

This is typical of the work undertaken by the BICC Organization.

With Branches and Agents in every continent backed by vast manufacturing resources and experience, BICC are able to supply and install transmission equipment anywhere in the World.



B.I. Callender's

33 kV CABLE FOR CAPE TOWN

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

RESISTANCE WIRE

80/20 or 65/15 Nickel Chrome
Drawn to Resistance or to Size
Bright Annealed or Oxidised
Sizes to 47 S.W.G. or to B & S Gauges
Even Spooling
Good Deliveries Given

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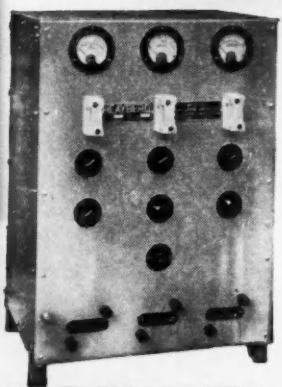
BATTERY CHARGERS
RECTIFYING EQUIPMENT



MODEL 63
Circuit 1
Charges 24 volts at 1 ampere
Circuit 2
Charges 24 volts at 2 amperes
Circuit 3
Charges 24 volts at 5 amperes

HEAYBERD BATTERY CHARGERS, incorporating metal rectifiers, embody the results of more than 20 years' experimental work and the understanding of customers' special requirements.

No matter how large or small, we shall be glad to quote for Battery Chargers and Rectifying Equipment made to suit your own particular purpose. The following lists are obtainable on request:—

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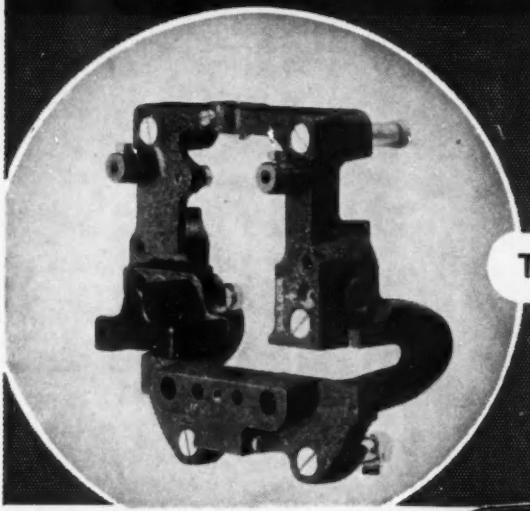

THE MAIN FRAME

PM97

The main frame is a robust casting made in the Ferranti foundry. The driving and braking systems are attached to it by dowels giving great stability to the meter's performance and ensuring similarity of performance in individual meters. It provides an excellent magnetic screen between the driving and braking systems.

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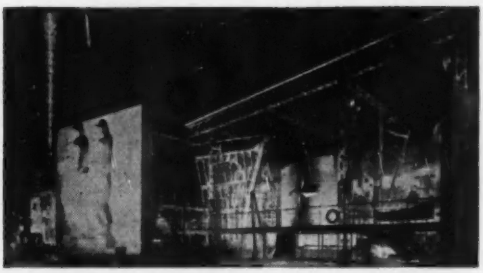
K/RM.69

Simplex

at the Festival— here there & everywhere



at the Sea and Ships Pavilion—with Simplex LS 61 Weatherproof floodlights (circular-beam, narrow angle). Simplex bulkhead fittings, too

at Car Parks—with about 300 Simplex floodlights in the SE London & Clapham Common Parks; and with similar Simplex floods in the Exhibition car parks

at the SS Campania, the Floating Festival of Britain —with Simplex General Purpose (LS 54) and medium range (LS 30 & 31) floodlight projectors

Can we help you with some bright lights?

MADE BY THE HOUSE OF Simplex

Simplex Electric Company Limited Oldbury Birmingham and Branches A TI COMPANY

Rewinding a 35 h.p. 500v. D.C. motor with "Fibreglass"—base insulation for class B duty in a glass works. Photo by courtesy Pilkington Brothers Ltd.

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— for ELECTRICAL INSULATION

Yarns, Tapes, Sleevings & Tying Cords

Experience has shown that a low alkali content is essential in glass textiles used for electrical insulation. " Fibreglass " yarn is substantially free from alkali and is **Electrical Insulation at its best.**

The price of inferior insulation is a heavy one. If insulation is destroyed, electrical equipment fails—valuable working hours are lost—important deliveries are delayed. Nothing but the best insulation available is good enough for your equipment. Since " Fibreglass " is made of glass, it is inorganic, acid resistant, and unaffected by corrosive fumes or heat—and since the glass is very low in alkali it is also unaffected by moisture.

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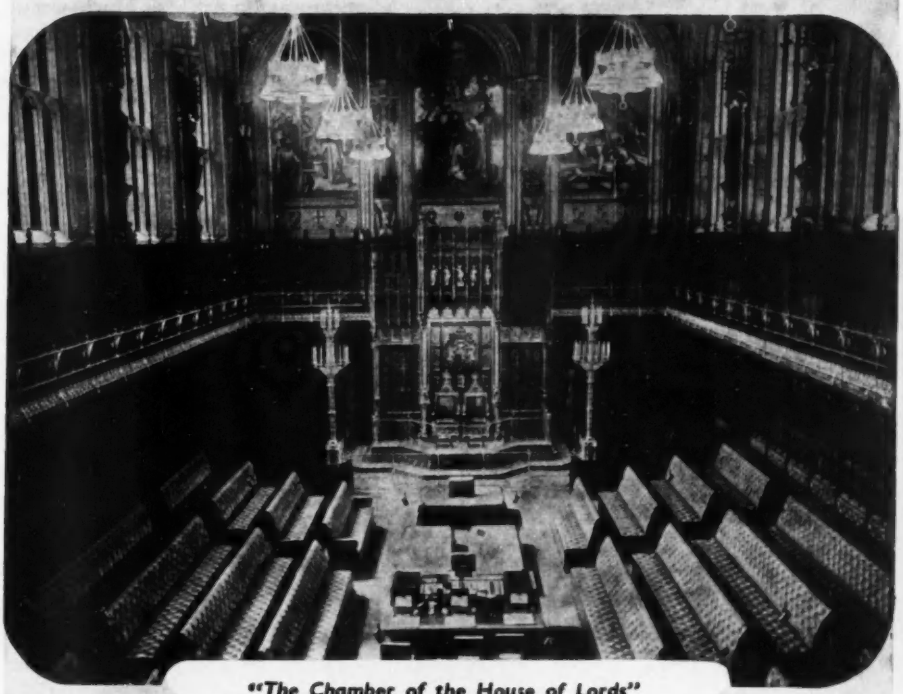

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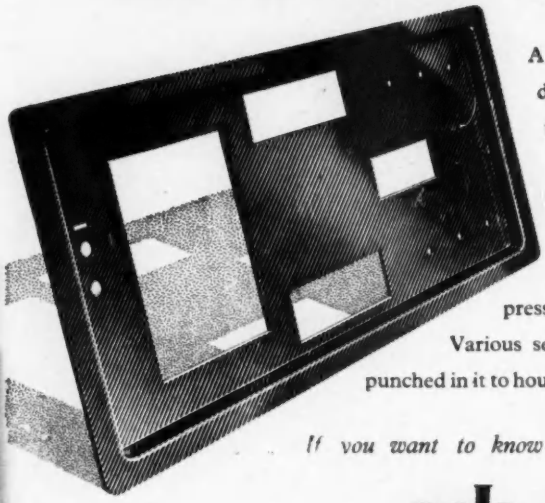
This one looked all right on paper



A customer recently came to us with a design for a fuse shield that set us thinking pretty hard. We were asked to provide an article with high strength/weight ratio and good electrical insulation properties, at a low price. The shield was produced as a high pressure moulding in our PLF paper grade. Various selections of holes and slots were then punched in it to house the appropriate arrangement of fuses.

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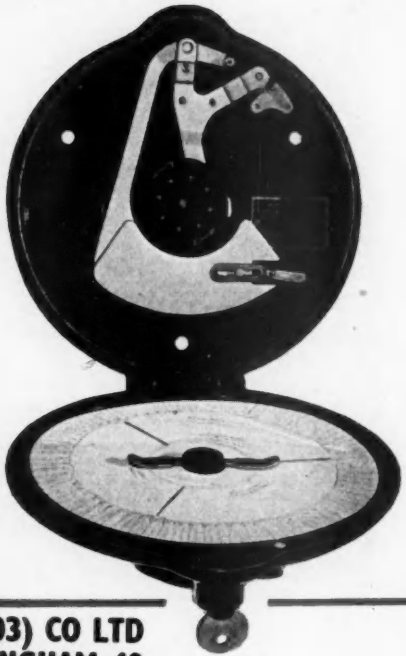
CASTING OPERATION

FOR REGULARITY OF FINISH

The illustration shows pressure die cast components for Servis Recorders. Our customer says, "We have been using your aluminium pressure castings for upwards of twenty years and we have found nothing to surpass them in regularity of finish. Our instruments are in use in all parts of the world and we have never yet had a single complaint regarding the parts you make for us. We have also come to appreciate and to rely on your Drawing Office and Design Staff, who have always been most helpful in the development of new types, and we look forward to continuing our co-operation with you for many years to come."

Extract from letter received from Servis Recorders., Gloucester.



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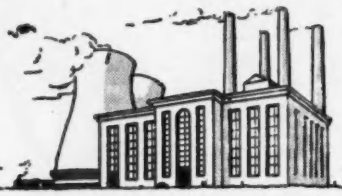

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The NEW all porcelain, 10 amp, 2-way Splitter

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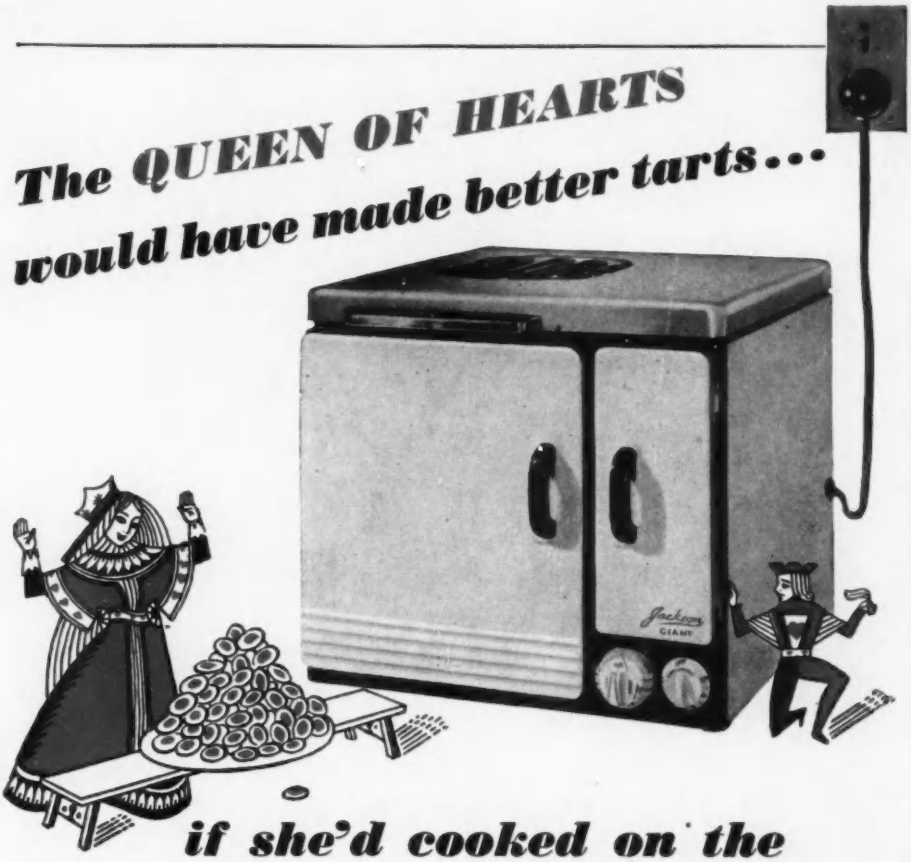

if she'd cooked on the 'GIANT' that Jackson built

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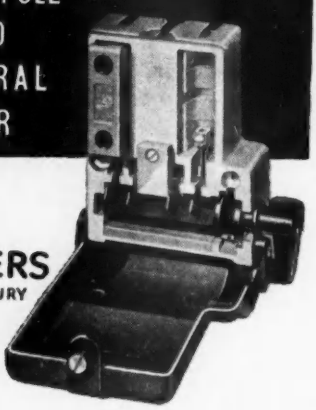

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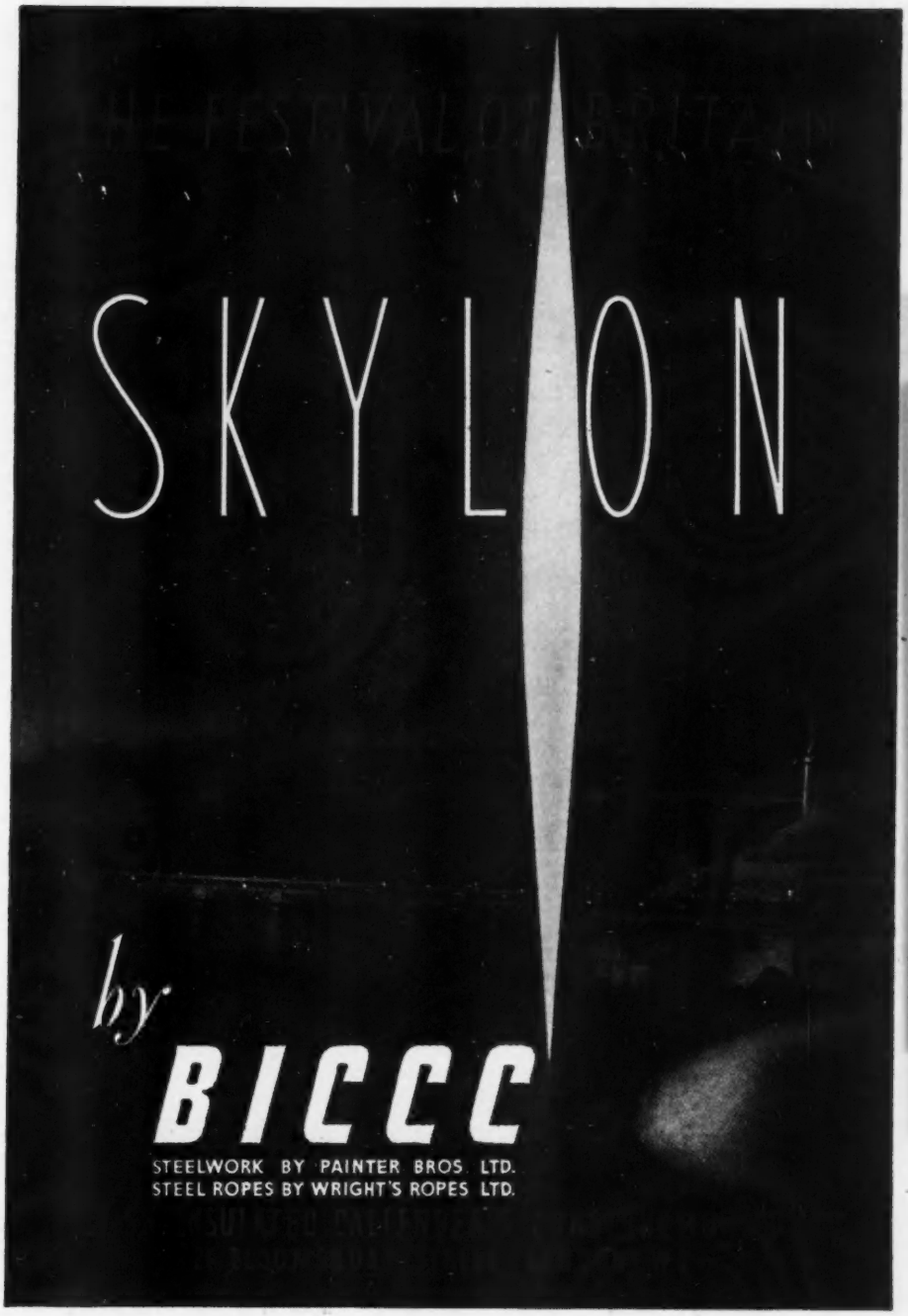
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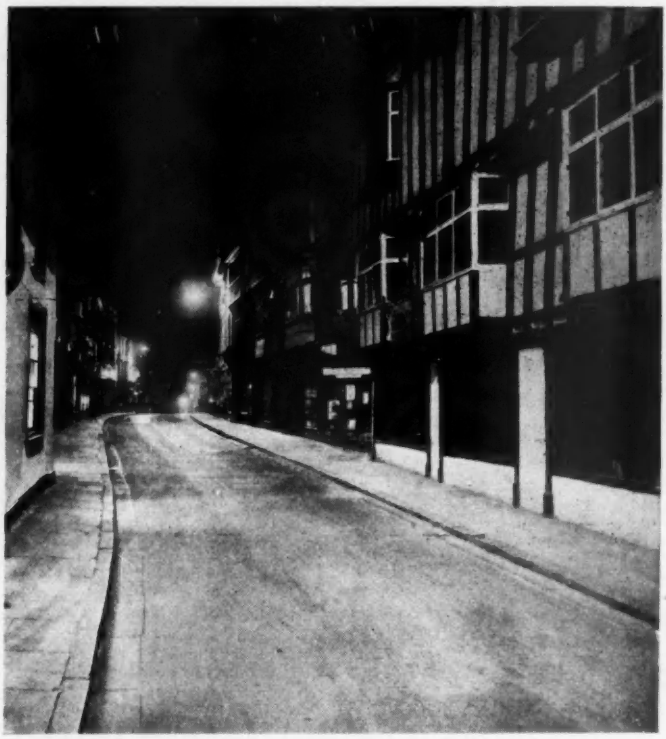

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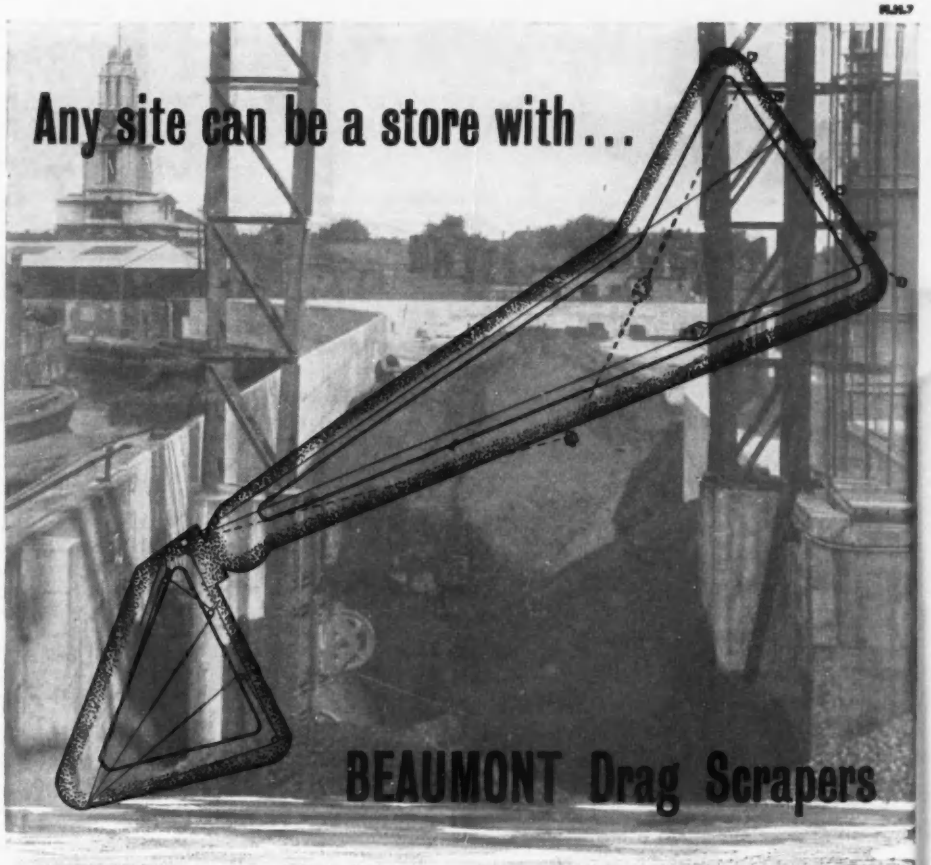

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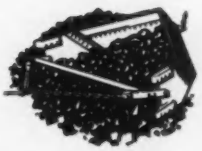

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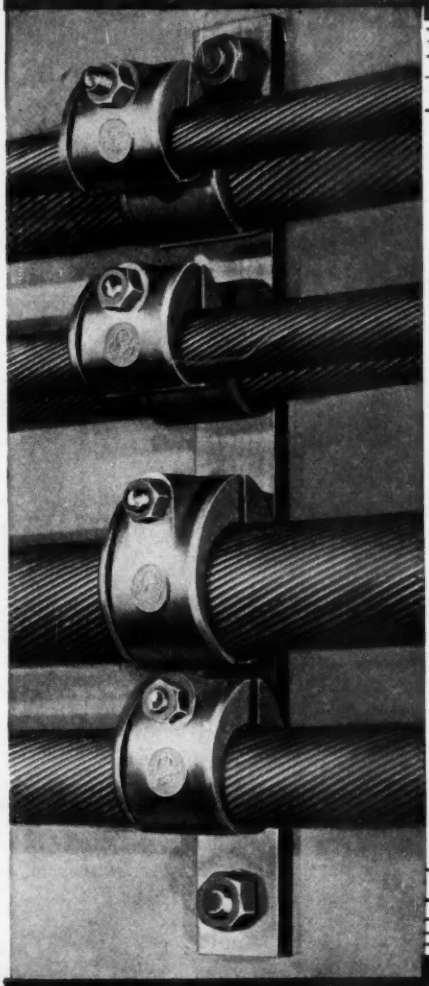

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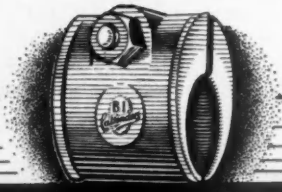
Further information is available in Publication 287W, available on request.



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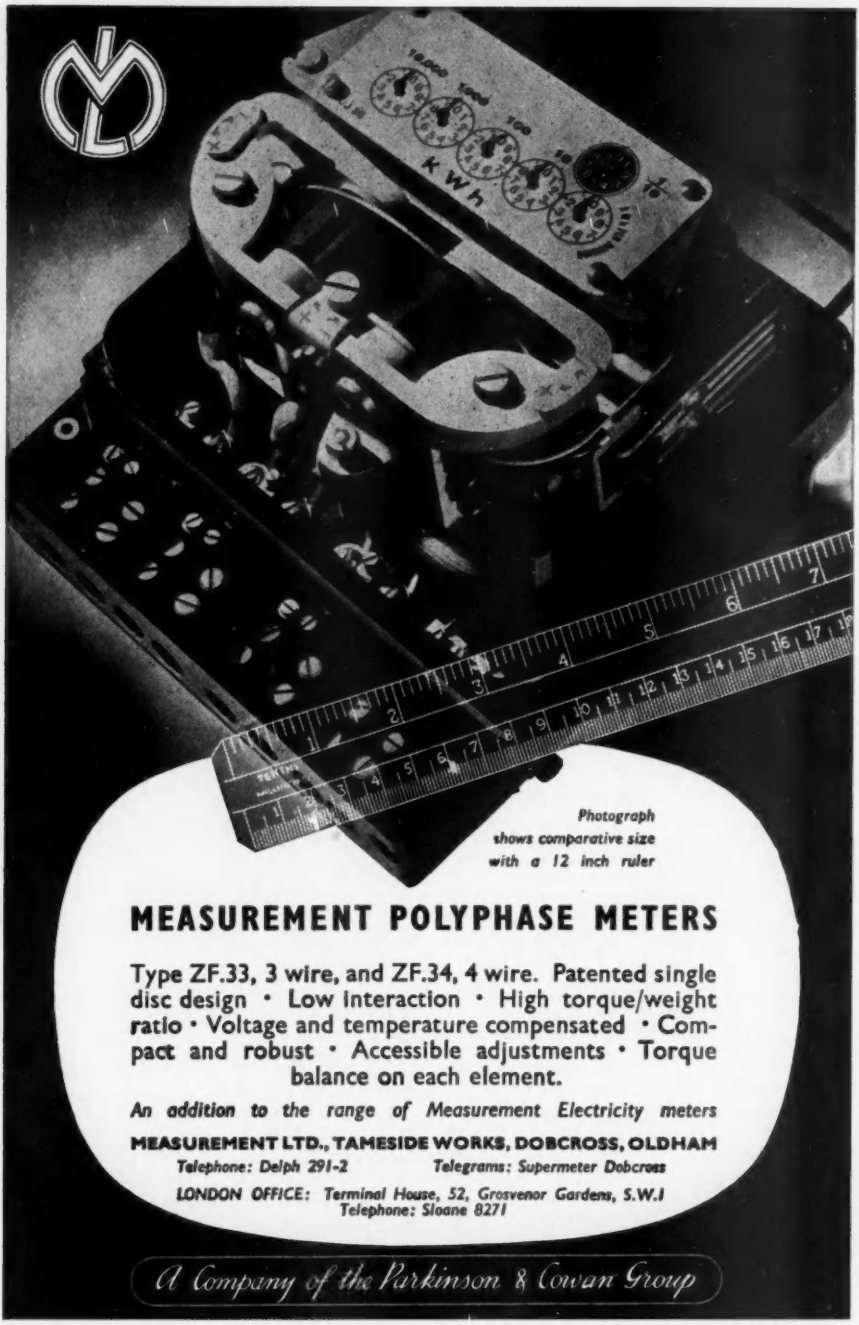

Photograph shows comparative size with a 12 inch ruler

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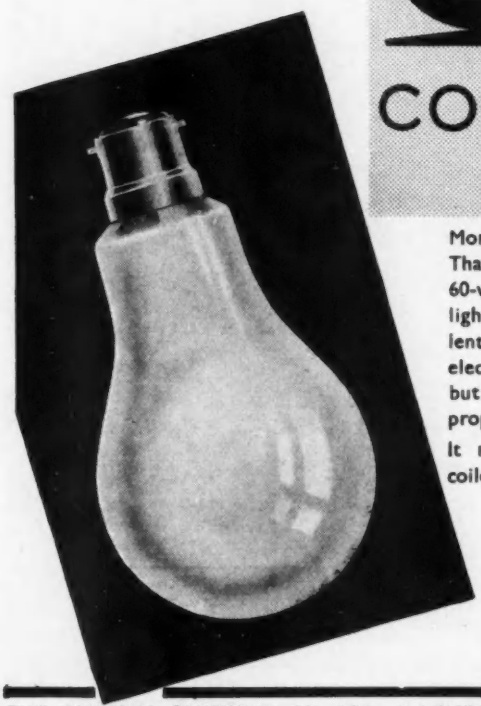

More light without using any more current—That's worth thinking about. Take the OSRAM 60-watt coiled-coil lamp, which gives 15% more light than an ordinary tungsten lamp of equivalent wattage, but does not use any more electricity. It costs an extra few pence more, but the extra light makes it a more economical proposition.

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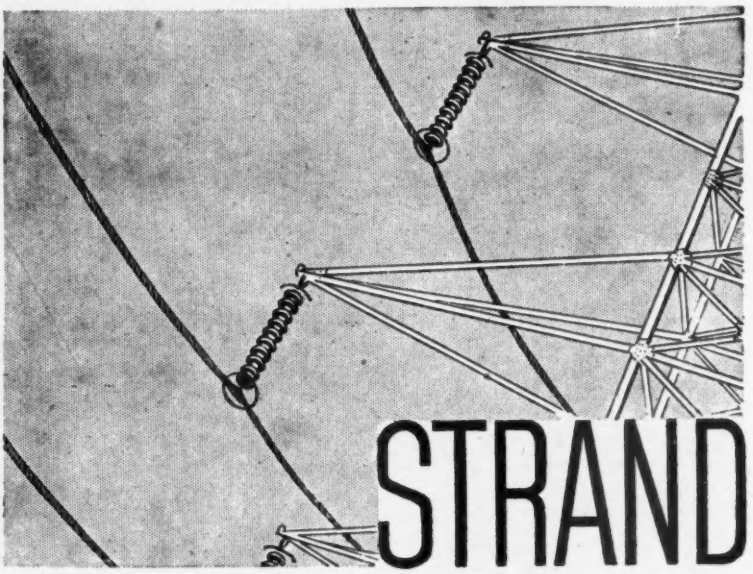

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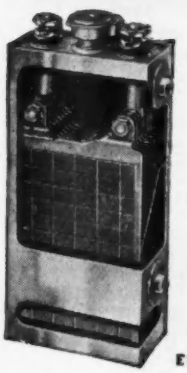

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ELECTRICAL TIMES

Vol. 120 No. 3114 THURSDAY 12 JULY, 1951

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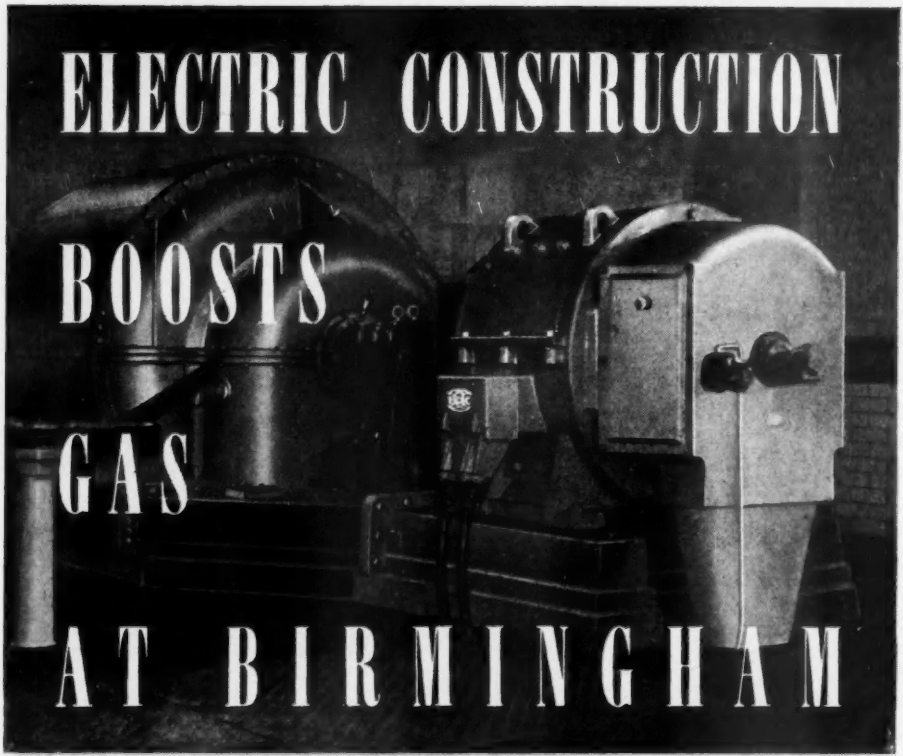

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Editorial

ACCOUNTABILITY

THE problem of providing an adequate measure of control of nationalised bodies is one which is seriously exercising the minds of those in authority, and the debate last week in the House of Lords showed how widespread is the concern on this matter of accountability. Perhaps the clearest statement of the difficulties is to be found in the quotation given by Lord Strabolgi, which is the more alarming since it comes from a confidential report by the nationalised industries group of the Parliamentary Labour Party.

> "As far as Parliament is concerned there is little or no control of public corporations apart from ministerial control exercised privately."

Of solutions to this lack of control, many have been advanced, ranging from full freedom of parliamentary question to inquiry by the Monopolies Commission. Unfortunately, there is not one which does not create something of a commercial strait-jacket for the Boards which may be inimical to efficient operation. The real difficulty lies in the paradoxical effect of granting the great monopolies full freedom of commercial action and at the same time providing a measure of control to ensure adequate accountability to the public and to allay Parliament's inherent fear of its own creations.

—*FOR WHAT?*

IT seems to *Meteor* that with all this talk of public accountability there is very little clear thinking on what it is exactly that the Boards are to be accountable for. And that must come first. It is commonly agreed that Boards should be free from questioning on certain undefined day-to-day activities, but is the ultimate accountability to be for consumer service, for conformity with public policy, or for commercial efficiency? The former is clearly a matter that should be within the ambit of the consultative councils, although these councils are themselves on trial at the present time. If it be public policy that is concerned, Parliament has its remedy by question and by annual debate on the report. That such debates are usually inept is generally acknowledged, and it is clear that any unimpassioned inquiry must be held outside the Westminster arena; yet members seem loth to employ the services of "outside experts." If, however, the examination is to extend to commercial efficiency, any inquiry could hardly be confined within the House. Perhaps the answer may be found in a joint parliamentary and commercial committee, but before any step is taken to determine the accountability of Boards, let us decide exactly for what they are accountable.

RURAL STYMIE

RURAL electrification is not prospering in Ulster. With £1¾ million schemes approved, the annual report of the Northern Ireland Electricity Board expresses disappointment at the 6½% return they are receiving on their expenditure. No one will disagree with the Board's view that such expenditure is not justified for the supply of lighting and wireless sets alone, nor that evidence of intention to make wider use of the availability of electricity should be asked for before capital expenditure is incurred. But with the low return obtained from rural areas that have only bottled gas and oil as competitors, it is difficult to escape the conclusion that the selling approach has been inadequate. Farmers are inherently conservative in their viewpoint, and as far apart as the T.V.A. and our own country it has been found necessary to adopt an aggressive sales policy of demonstration, both for the farmer and his wife at their own doorstep, if full usage of electricity is to be obtained.

DETAILS, PLEASE

IN these days of long delivery times and fluctuating raw materials costs, it is important to the smooth execution of any engineering project that orders for materials and components be finalised as soon as possible. Often attainment of this end may be helped by attention to the manufacturer's frequently repeated plea—include full particulars with inquiry. There is one difficulty: what are the *relevant* particulars? Faced with a mass of details, most of which he thinks are peculiar to his own circumstances, the engineer finds it difficult to decide which are of interest to the manufacturer; letters pass, and time is lost. It is to help the engineer who has this trouble when inquiring about cables, that we are offering the article by Mr. Barnes, with which our journal opens this week. It is recommended for study at present and for filing for the future. The week that it may save at the beginning of the order may mean a month by the time delivery is made.

WINGED WORDS

SURVEYING, for a moment, Reuters centenary celebrations this week, it is interesting to regard the way in which electrical communications and this famous agency have grown up side by side, with the telegraph the senior by a few years. For, although telegraphic working between Euston and Chalk Farm had taken place as far back as 1837, the first telegraph company to link Birmingham, Manchester, Liverpool and other cities was only formed in 1846. Julius Reuter set up his agency in England a few months before the Continental submarine cable began to link France and Britain, and the copper wire—instead of the reeling packet and the lathered horse—brought the Bourse prices to the Stock Exchange. The telegraph, which had driven him out of Aachen by superseding his pigeon post, became his valued servant—his own private line on the Irish coast used to give him an eight-hour lead on his competitors with news from America. Many times his organisation has had to be remodelled to fit in with the increasing tempo of communications, and some idea is given from the difference in time between an early "beat"—the assassination of Abraham Lincoln in 1865, and a recent one, the dismissal of General MacArthur. In the absence of an Atlantic cable (the "1857" cable having broken down within a few months) the earlier story took a fortnight. The other was being distributed from London within three minutes of transmission from Washington. It is interesting to speculate what further advances will be made in the speeds of either news-gathering or actual communications. The time in transmission between the sender and receiver is fixed by physical laws, and the chief room for improvement seems to be in the organisation for dispatching and routing messages. It seems that the limiting factor—the human equation—is common to both.

DANGEROUS STATISTICS

THAT the household with gas supplies, but no electricity, pays less for its chosen fuel than the household which eschews gas and makes use of electricity, is likely to be the boast of the gas industry before long. The source will confidently be quoted—a Government Social Survey report, based on a country-wide sampling survey. Is the claim true? Yes, but there are many qualifying considerations, and the report, a sound compilation on statistical principles, carefully points them out. For the sake of succinctness, though, the gas interests and their friends are likely to exclude such notes; so it behoves those in the electricity supply industry who will have to counter such claims, to familiarise themselves with the full contents of the report. They will find that the results of the survey really offer strong support for the economy and popularity of electric appliances. This is especially welcome as the findings, tentative as they are, and now nearly three years old (they are based on an investigation carried out in 1948-49) are likely to be accepted as a source book for Governmental ideas in the field of co-ordinated fuel policy planning.

Meteor

CABLE ENQUIRIES

Estimating is facilitated if the manufacturer is sent all the essential details of installation conditions with the original enquiry for quotation

C. C. BARNES, A.M.I.E.E., gives some useful pointers for purchasers of cables

POWER cables form a vital and necessary link in any electric transmission, distribution or utilisation scheme, but enquiries (and orders) are frequently issued giving very limited data, and consequently loss of time and inconvenience are experienced.

To enable the manufacturers to tender satisfactorily and in order to avoid the necessity for submitting alternative schemes because of the omission of essential data, it is desirable that the prospective customer should provide comprehensive details of his requirements. The following notes are, therefore, offered as a guide to purchasers of paper insulated power cables. They review briefly the factors which should be considered. Data is provided relating to paper insulated power cables for voltages up to 22 kV (B.S. 480, 1942), but in view of present demands for cables operating at 33 kV and higher voltages, which are not covered by British Standards, the various super-voltage cable designs are also reviewed.

Modern power cables[1] consist of conductors stranded from high conductivity plain annealed copper wires insulated with oil-impregnated paper tapes; the single or multicore assembly is then enclosed in an impermeable tube of lead or lead alloy.

Sheaths and Protection

During the past few years very careful consideration has also been given to the use of aluminium sheaths[2] for power cables in view of the rapid price increase for lead and also because the weight of a lead alloy sheath restricts both the cable dimensions and drum length. (The specific gravity of lead is 11·37 as compared with 2·71 for aluminium.)

In the case of lead sheathed power cables the sheath is protected from corrosive elements by the double layer of heavily compounded paper tapes followed by a layer of jute roves or hessian tape and mechanical protection is provided by a double layer of steel tape or a layer of steel wires followed by an outer covering of compounded textile material. Table 1 gives a summary of standard textile servings and the metallic armourings applied over the lead sheathed cable, together with the method of installation associated with each type of finish.

With regard to aluminium sheathed cable, tests and investigations have shown that the normal type of cable protective coverings are effective, but service experience on this point is still being acquired.

Super-Voltage Cables

The current British Standard for paper insulated and lead sheathed cables (up to and including 22 kV) is B.S. 480: 1942. For use at these voltages, multicore cables of the belted type (Fig. 1) have given splendid service. This is in spite of the fact that the dielectric within the electric field is non-homogeneous, by reason of the presence of fillers of different permittivity which are necessary to make the cored-up cable circular in cross section.

Although this non-homogenity leads to distortion of the electric field and so gives rise to tangential stresses in the cable dielectric, these tangential stresses are relatively unimportant until the operating voltage is raised above 22 kV. As the operating voltage of the system is increased, however, the electric stresses in the dielectric have to be increased since otherwise the thickness of the dielectric and overall dimensions of the cable would become prohibitive both from the economic and from the manufacturing point of view.

A modified design (first patented by M. Hochstadter in 1914) known as the "H" or screen-type cable, solved the problem for higher operating voltages (i.e., 33 kV and 66 kV). In the screened type of cable each insulated conductor is separately screened by means of either metallic or metallised tape or a lead sheath; any fillers which are necessary are outside this screen and, consequently, they will be outside the electric field.

There are three main types of screened

cables: "H" type round conductors; "H" type oval conductors and "H.S.L." type round conductor. Dielectric and lead thicknesses for 33 kV cables are not included in B.S. 480: 1942, but Table 2 records minimum insulation and lead thickness to the so-called "C.M.A. New Standards."

Recent years have seen increasing use of oil-filled cables and gas pressure cables in which gas is either in contact with the oil-impregnated paper dielectric or is separated from the dielectric by means of a thin lead or thermoplastic sheath. In the oil-filled cable a fluid oil is maintained under a pressure and longitudinal ducts are provided either in the conductor or (in the case of 3-phase cables) in the filler spaces. The oil-filled cable is impregnated with a very fluid oil and in operation this oil is always kept under a positive pressure at between about 6 and 50 lb/sq in. by means of an external pressure reservoir and auxiliary equipment arranged at selected feeding points on the route. Owing to the low fluid resistance within the oil-filled cable a relatively low pressure is sufficient to prevent void formation. With the gas pressure design a positive pressure is maintained on the dielectric either by means of a gas under pressure between the dielectric and the pressure retaining sheath, or by the application of an external gas pressure on the cable sheath. Any gaseous spaces which may form in the dielectric are thus always kept under a sufficiently high pressure to prevent ionisation and deterioration in service[3].

A detailed review of these designs will be found elsewhere[5], but Fig. 2 provides a broad classification of British s.v. cables, and Table 3 summarises the principal characteristics of the four commercial designs of gas pressure cable now available.

Data for Enquiries

Cable enquiries can be divided into two main classes—those in which the purchaser has decided on the size and type of cable required, and the second category in which the cable-maker is requested to make recommendations.

Dealing with the first type of enquiry, essential information is summarised by: (*a*) number of lengths and cable length required per drum; (*b*) conductor section (e.g., 0·0225 sq in. or 7/·064 strand); (*c*) number of cores; (*d*) working

TABLE I.—Power Cable Armouring and Servings

	Protection over the lead sheath	Method of Installation	Comments
1	Lead or lead alloy sheath (without external wrappings).	On cleats or cable racks in buildings, power stations, underground electric railways and other positions which are normally inaccessible.	A lead alloy sheath is recommended for positions where vibration may occur, e.g. on bridges, roof girders, under roads carrying heavy traffic, etc.
2	Lead sheath, two compounded paper tapes, textile serving (jute roves or hessian tapes).	Laid direct in the ground.	Must be protected by cover boards or tiles and laid only in soil known to be free from chemicals. The bottom of the cable trench must be free from stones and covered with a layer of riddled earth to provide a soft bedding for the cable.
3	Lead sheath, closely compounded braid of cotton, jute or asbestos.	In free air.	Mainly for mining work, ships installations, or inside buildings. The asbestos braided finish provides an excellent fire resisting covering.
4	As (2) followed by a double layer of compounded steel tape, compound textile serving overall.	Low and medium voltage cable circuits laid direct in the ground.	Must not be used where the armouring is subject to tensile stresses.
5	As (2) followed by a single layer of steel wires left bright.	(1) Cables in free air. (2) Pulled into ducts.	When installed in or around buildings it is important to specify whether for inside or outside use so that the most suitable type or armouring compound may be used.
6	As (5) followed by compounded textile serving over the steel wire armouring.	Alternative to (4) but chiefly used for higher voltage cables laid direct in the ground.	More expensive than d.s.t.a. but offers a good protection and does not have the same limitations with regard to installation conditions.
7	As (2) followed by first layer of steel wires, compounded textile separator, second layer of steel wires, compounded textile serving overall.	Mine shafts, submarine cables, or special conditions (i.e., large copper sections where the weight of the cable has to be taken by the wire armouring).	In many cases d.w.a. is preferable to s.w.a. because smaller wires can be used and greater flexibility is obtained, also necessary where the required tensile strength cannot be obtained with s.w.a. Often essential for mining work where the requirement is specified that the metallic covering shall have at least 50% of the conductivity of the largest conductor (particularly for non-lead sheathed types, i.e. vulcanised bitumen, or compound insulated cables).

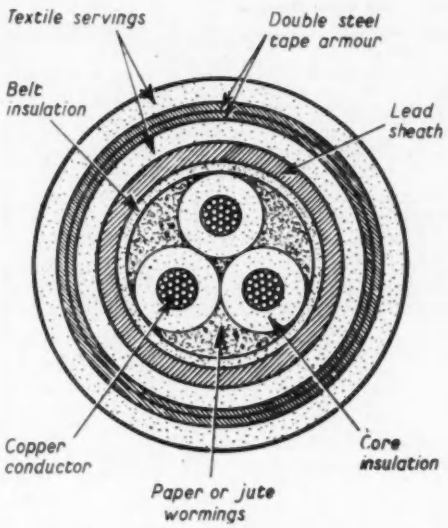


Fig. 1.—Three-core belted cable construction

voltage (phase to phase); (*e*) if lead sheathed only or lead sheathed and served; (*f*) type of armour if required, e.g. double steel tape (d.s.t.a.), single or double wire armour (s.w.a. or d.w.a.); (*g*) if above 660 V, state whether the system is earthed (E) or unearthed (U.E.).

Example: Two lengths, each 500 yd per drum, 19/·083 in. shaped conductors 3-core paper insulated and lead covered, 3,300 V, double steel tape armoured and served. Unearthed system to B.S. 480: 1942. This may be abbreviated to 2 x 500 yd, 19/·083 in. shaped 3-core p.i.l.c., 3·3 kV, U.E. d.s.t.a. and served.

The second type of enquiry is that in which the manufacturer is requested to make recommendations. In the absence of a detailed cable specification the following is a guide to the data required.

Type of supply system: e.g., 250 V, d.c., 2-wire; or 400/430 V, 3-phase, 4-wire, a.c. supply; or 6,600 V, 3-phase, a.c. system centre point earthed, etc. *Power load*: current per phase (amp) or load in kilovoltamp (kVA), kilowatts (kW), stating power factor, or horsepower (h.p.), stating also the power factor and efficiency of the motor (if known). *Voltage drop*: state maximum permissible figure, and whether phase to phase or phase to neutral voltage. *Method of installation*: if the load is intermittent and the most favourable current rating is required give full particulars of the load cycle, i.e. average load 250 amp for eight hours, no load 16 hours, six days per week.

Fig. 3 provides a résumé of essential data which should be submitted with enquiries for power cables if it is intended that the manufacturer shall specify the conductor size required, and the permissible current rating of the cable, while Table 5 gives a summary of formulae used for computing the load current and voltage drop in a.c. and d.c. systems.

TABLE 2.—Minimum Dielectric Thicknesses for 33 kV Screened Cables

(*C.M.A. New Standards; centre-point-earthed systems only*)

Nominal area of conductor sq in.	Minimum dielectric thickness—in.		Minimum lead thickness—in.		
	3-Core screened and 3-core H.S.L. type cables	Single core screened type cables	3-Core screened	3-Core H.S.L.	Single core
0·10	0·315	0·335	0·12	0·08	0·10
0·15	0·300	0·325	0·12	0·08	0·10
0·20	0·300	0·325	0·13	0·08	0·10
0·25	0·280	0·300	0·13	0·08	0·10
0·30	0·280	0·300	0·13	0·08	0·10
0·40	0·280	0·300	0·14	0·09	0·10
0·50	0·280	0·300	0·15	0·09	0·10
0·60	—	0·300	—	—	0·11
0·75	—	0·300	—	—	0·11
1·00	—	0·300	—	—	0·11

Fig. 2.—Supertension cable designs

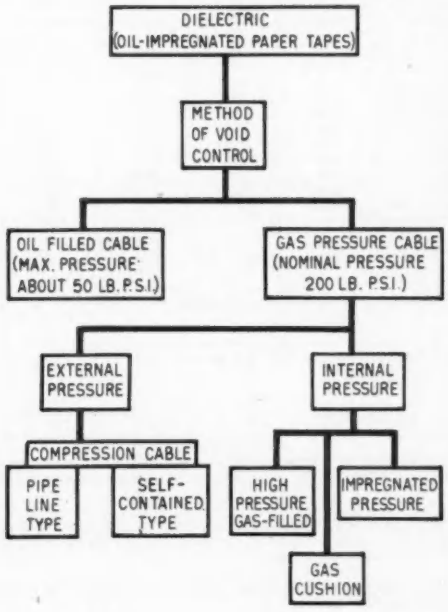


TABLE 3.—British Supertension Gas Cable Designs

Designation	Normal and maximum operating gas pressure	Special characteristics	Maximum design stress	Permissible temperature rise*		Maximum conductor temperature
				Laid direct or in ducts	In air	
Compression cable (originally termed pressure cable)	200 and 250 lb/sq in.	The gas is separated from the oil impregnated dielectric by diaphragm lead sheaths	Up to 110 kV/cm	70° C	60° C	85° C
High pressure gas-filled cable	200 and 250 lb/sq in.	(1) Conductors passed through smoothing dies to provide a flat bed for screening metallised papers applied over the strand. (2) The dielectric is built up from pre-impregnated paper tapes. (3) Nitrogen gas is in contact with the dielectric.	Up to 85 kV/cm	70° C	60° C	85° C
Impregnated pressure cable	200 and 250 lb/sq in.	Nitrogen gas is in contact with the dielectric	Up to 100 kV/cm	70° C	60° C	85° C
Gas-cushion cable	200 and 250 lb/sq in.	Nitrogen gas is in contact with the dielectric	Up to 85 kV/cm	70° C	60° C	85° C

* Assumed ground temperature 15° C; assumed ambient air temperature 25° C.

TABLE 4.—Minimum Continuous Current Ratings of Belted and Screened Paper Insulated Cables laid Direct in the Ground

Ground Temperature 15° *C* (59° *F*). *Ground Thermal Resistivity* (*g*) = 120° *C*/*Watt*/*Cm*³.

Nominal Area of Conductors	660 V 3 single core served cables touching in trefoil formation (unarmoured)	660 V 3 and 4 core cables with shaped conductors (armoured)	3·3 kV to 11 kV single core served cables touching in trefoil formation (unarmoured)	3 core cables with shaped conductors (armoured)			33 kV 3 core H type l.c. and armoured Circular conductors	33 kV 3 core H type l.c. and served Circular conductors	33 kV single core H type l.c. and served in trefoil formation Circular conductors	66 kV single core H type l.c. and server in trefoil formation Circular conductors
				3·3 kV	6·6 kV	11 kV				
Sq. in.	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
0·007	54	47	—	—	—	—	—	—	—	—
0·0145	77	67	—	—	—	—	—	—	—	—
0·0225	101	93	99	90	88	85	—	—	—	—
0·04	142	128	135	125	123	119	—	—	—	—
0·06	180	162	170	158	156	150	150	150	150	—
0·10	239	216	228	210	208	200	195	200	200	—
0·15	299	271	282	263	261	250	240	245	245	—
0·20	350	329	331	308	307	291	280	290	285	275
0·25	397	358	372	349	348	331	315	325	325	310
0·30	436	400	403	387	386	369	350	365	360	345
0·40	502	465	464	447	446	427	400	425	415	400
0·50	564	517	522	492	491	471	440	475	460	440
0·60	610	568	578	—	—	—	—	—	500	480
0·75	675	612	640	—	—	—	—	—	545	520
1·00	764	652	—	—	—	—	—	—	615	—
1·25	814	—	—	—	—	—	—	—	—	—
1·50	880	—	—	—	—	—	—	—	—	—
Max. Conductor temperature	70° C	70° C	70° C	70° C	70° C	65° C	65° C	65° C	60° C	60° C
Depth to cable surface	18 inches		36 inches				42 inches			

Ratings for cables up to and including 22 kV are based on published recommendations of the British Electrical and Allied Industries Research Association (Report F/T128). Ratings for 33 and 66 kV cables are based on published data by the Cable Makers Association.

SINGLE CORE CABLES.—Ratings are based on the assumption that cables are in trefoil formation and the lead sheaths are bonded at both ends of the run. Ratings up to 11 kV apply to cables for both earthed and unearthed systems. Ratings for 22 kV and higher voltage cables apply to earthed systems only.

33 kV cables with shaped conductors have, in general, slightly higher current ratings than the corresponding cable with circular conductors, as listed above.

1. Length of cable route.
2. Cable specification.
3. Load: H.P. (state also power factor and motor efficiency) or kW (state also power factor) or kVA.
4. Details of power system.
5. Centre point earthed or unearthed.
6. Method of installation: (i) laid direct; (ii) in air; (iii) pulled into ducts.
7. No. of circuits and method of grouping.
8. Depth of laying to top of cable or duct bank (D): (i) duct material: (ii) dia. of duct; (iii) spacing of ductways.
9. Soil thermal resistivity.
10. Initial temperature (soil or air).
11. Max. permissible conductor temperature.
12. Temperature rise of conductor.
13. Any special route conditions.
14. Overload or intermittent loading.
15. Max. permissible voltage drop.

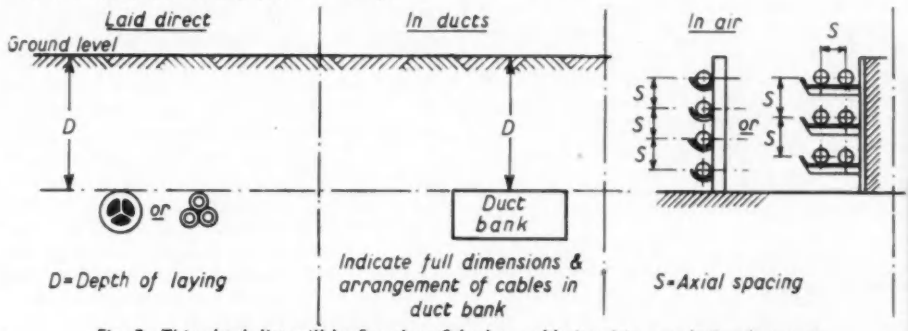
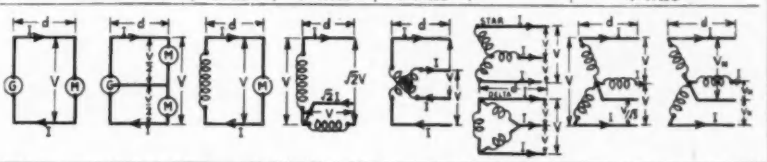


Fig. 3. This check list will be found useful when cable inquiries are being drawn up

TABLE 5.—Calculation of Current and Voltage Drop in A.C. and D.C. Systems

η = Efficiency of motor (or average efficiency of motors).
Cos ϕ = Power factor.
d = Distance in yards.
R = Resistance of one conductor in ohms/1,000 yds. carrying the current I only (both R and Z values are at 60° F. or 15·6° C.).
Z = Impedance of one conductor in ohms/1,000 yds. carrying the current I only.
X = Reactance of one conductor in ohms/1,000 yds. carrying the current I only.
I = Current in amperes (see graphical representation below).
t = Temperature correction factor. Refer to Fig. No. 4.

It is important to note that the heating effect of the load current increases the ohmic resistance of the conductor above the "standard" resistance at 60° F (15·6° C) given in B.S. 480 : 1942, and Fig. 4 gives "temperature correction factors" for adjustment.

1 System of Supply	2 D.C. 2-Wire	3 D.C. 3-Wire	4 A.C. Single Phase	5 A.C. 2-Phase 3-Wire	6 A.C. 2-Phase 4-Wire	7 A.C. 3-Phase	8 A.C. 3-Phase 4-Wire	9
Graphical Representation								
Current (I) in Amps	$\frac{HP\times 746}{V\times\eta}$ $\frac{kW\times 1{,}000}{V}$		$\frac{HP\times 746}{V\times\eta\times Cos\phi}$ $\frac{kW\times 1{,}000}{V\times Cos\phi}$ $\frac{kVA\times 1{,}000}{V}$	$\frac{HP\times 746}{2V\times\eta\times Cos\phi}$ $\frac{kW\times 1{,}000}{2V\times Cos\phi}$ $\frac{kVA\times 1{,}000}{2V}$		$\frac{HP\times 746}{\sqrt{3}\times V\times\eta\times Cos\phi}$ $\frac{kW\times 1{,}000}{\sqrt{3}\times V\times Cos\phi}$ $\frac{kVA\times 1{,}000}{\sqrt{3}V}$	$\frac{HP\times 746}{3\times Vn\times\eta\times Cos\phi}$ $\frac{kW\times 1{,}000}{3\times Vn\times Cos\phi}$ $\frac{kVA\times 1{,}000}{3\times Vn}$	
Voltage Drop — Insulated Cable	$\frac{2\times I\times d\times R\times t}{1{,}000}$			$\frac{2\times I\times d\times Z\times t}{1{,}000}$		$\frac{1{\cdot}732\times I\times d\times Z\times t}{1{,}000}$		
Voltage Drop — Overhead Lines				$\frac{2\times I\times d\ (Rt\cos\phi+X\sin\phi)}{1{,}000}$		$\frac{1{\cdot}732\times I\times d\ (Rt\ Cos\ \phi+X\ Sin\ \phi)}{1{,}000}$		

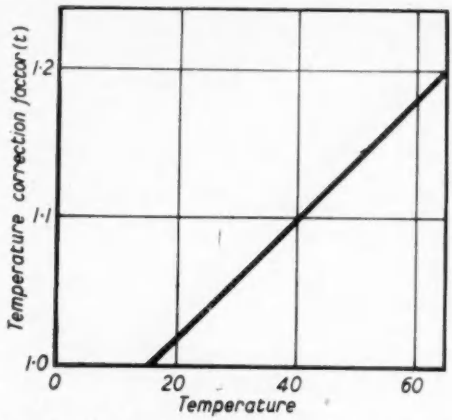


Fig. 4.—Temperature correction curve for use with Table 4

The following depths to the cable axis are standard in this country for cables buried direct in the ground (normal ground temperature 15° C): 660V working pressure—18 in. (45·8 cm) plus radius of complete cable; 3·3 kV-22 kV (inclusive)—36 in. (91·5 cm) plus cable radius; 33 kV and above—42 in. (106·7 cm) plus cable radius.

When power cables are pulled into ducts (this method of installation is adopted where the district is congested and excavation work is difficult), the standard depths of laying, to the top of the duct are: 660 V-22 kV inclusive, 30 in. (76·2 cm); 33 kV and above, 42 in. (106·7 cm). Three-core cables should be installed in single way ducts, and where several circuits are involved, horizontal formation for the ductways should be adopted wherever possible. Single-core cables operating on d.c. circuits may be installed in three-way flat or trefoil ducts, but in the case of single-core cables operating on a.c. circuits, the trefoil type of duct is preferable.

Duct diameters recommended are: up to 2½ in. external diameter of cable—internal dia. of duct 4 in.; above 2½ up to 3½ in.—internal dia. of duct 5 in.; above 3½ in.—internal dia. of duct 6 in.

Ductways consist of earthenware, fibre, or metal tubes, and they must not be confused with open trenches (chases) made in concrete floors which are also often referred to as cable ducts. This distinction is of importance, since the current rating for a cable in a duct is much lower than for other installation conditions, whereas cables run in open trenches are virtually in free air.

The normal ambient air temperature is 25° C but for conditions known to be appreciably above this temperature (e.g. power station turbine rooms, boiler houses, etc.), the maximum temperature obtaining should be quoted, since high air (or ground) temperature reduces the permissible current loading. When cables are run outdoors and cannot be protected from the direct rays of the sun this fact should also be noted. Should any special method of installation be required, or any abnormal conditions exist, full details should be given.

Special conditions may include the following: presence of corrosive substance due to chemicals in the ground; proximity of electric traction circuits along part or all of the cable route which may result in electrolytic corrosion; excessively marshy or damp ground, cable routes having sections with a severe profile or long vertical runs; presence of hot pipes or other sources of heat which may necessitate rearrangements of the cable route; excessive vibration which often occurs when cables are installed on bridges, roof girders, or near travelling cranes.

In the case of factory installations it is very helpful to the manufacturer if the processes are specified, e.g. dye works, breweries, tan yards,

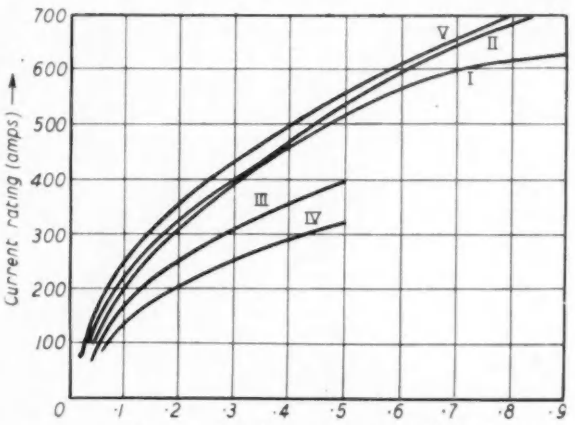


Fig. 5.—Effect on current carrying capacity of installation method

I—3 core armoured and served, laid direct. II—Wire armoured cables in air, left bright. III—Armoured cables in single way ducts, left bright. IV—Cables in single way ducts, lead covered only. V—Unarmoured single core cables laid direct in trefoil groups

etc., since this information provides a useful indication of the special conditions likely to be encountered.

Current Ratings [6, 7]

The fundamental problem of power cable engineering and operation is the determination of the maximum current carrying capacity (or power) which a cable or group of cables can transmit for specified installation conditions.

Under certain conditions, the conductor size will be fixed by consideration of temperature rise, in others, voltage drop, and it is important that both should be checked.

The permissible current loading of a power cable depends on three main factors: (1) the maximum permissible temperature at which its components may be operated, allowing a reasonable factor of safety based on experience; (2) the heat dissipating properties of the cable (i.e., thermal resistance of the cable). (3) the thermal dissipating qualities of the immediate surroundings which are dependent on the method of installation adopted.

The thermal resistance of a power cable is dependent on the number of cores, the dimensions, and thermal properties of the non-metallic components in the cable. In the case of cables buried direct in the ground, the thermal resistance of the soil increases with the depth of laying and by the close proximity of other loaded cables, due to mutual heating phenomena. The basic soil temperature in this country is taken as 15° C (59° F) and for cables in air a normal atmospheric temperature of 25° C (77° F) is assumed.

Heat dissipation from cables in air varies with the overall diameter, surface area, the nature of the surface (bright or dull) and the actual temperature. The rough black surface of a served cable has the highest rate of heat emission. Maximum permissible continuous current ratings for the range of solid type belted and/or screened paper insulated cables laid direct in the ground are given in Table 4. The method of installation[8] adopted has an important effect on the current rating as shown in Fig. 5, which gives the maximum continuous rating for 3-core and trefoil groups of single-core, 660 V, paper-insulated cables installed under differing conditions. It is important to note the higher loadings permitted for armoured cables laid direct in the ground, compared with those for armoured and unarmoured cables in ducts.

The maximum core temperature for plain lead covered cables in ducts is 50° C but a higher conductor temperature and consequently a greater current loading is permitted if the cable is armoured.

In general, the same cable will carry current in descending order of magnitude if : (1) laid underground; (2) in free air; (3) in single way ducts; (4) in multi way ducts; (5) based on the old rule of 1,000 amp per sq in. of copper section. This generalisation should be used with care, however, since it will be seen from Fig. 5 that for the smaller copper sections the permissible current loading is greater when laid direct, but for large cables the reverse is the case, the size at which the transition occurs varying with the type of cable. Careful consideration must, therefore, be given to the method of installation adopted in order to get the optimum rating for new installations.

TABLE 6—British Standard Specifications Relating to Power Cables

British Standard	Title	Voltage range
B.S. 443: 1939	Testing of Zinc Coating on Galvanised Wires	
B.S. 480: 1942	Paper Insulated Cables for Electricity Supply	660 V-22 kV earthed type (additional tables for 3·3 kV-11 kV unearthed type cables).
B.S. 760: 1943	Paper Insulated Cables for use in Mines	660 V-6·6 kV earthed and unearthed types.
B.S. 883: 1949	Cables & Flexible Cords for Electrical Equipment of Ships	660 V- 6·6 kV paper cables. 660 V-6·6 kV v.c. cables. Also range of v.i.r. and p.v.c. insulated cables and mineral insulated cables.
B.S. 1441: 1948	Galvanised High Tensile Steel Wire for Armouring Submarine Cables	
B.S. 1442: 1948	Galvanised Mild Steel Wire for Armouring Cables.	

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7. The Current Rating of Paper Insulated Power Cables. Barnes. *Electrical Communication*. 1942. Vol. 21, No. 1.
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Our readers' views . . .

Domestic Water Systems

A FEW months ago we were involved in trouble in connection with our work and learned yesterday that contractor friends in Ipswich had a similar misfortune about a week ago. You may feel the subject of sufficient importance to place before your readers.

An immersion heater was being fitted to the hot water cylinder of a domestic installation, and the work was not completed at the end of the day; the cylinder was left with the water turned off and the inspection plate removed. In both cases the water was not cut off efficiently, and during the night the consumer suffered serious flooding.

It seems that domestic stop-cocks when seldom used are not very reliable and that the valve seatings deteriorate. The leakage of water into the cylinder was not sufficiently fast to be obvious, and in our opinion the warning should be circulated to contractors.

H. A. Taylor

A. TAYLOR & SON (Eastern) LTD., BECCLES — A.M.I.I.A. Director

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Hydraulic Compressors

I HAVE shared the interest of your readers in the article on "Gas Turbines with Hydraulic Compressors" by David Murray in your issue of June 28, in which Mr. Murray details the proposals and speculations of the late Sir Edward MacColl. On page 1095 reference is made to the scheme detailed in Fig. 10 and to the high cost of civil engineering works to secure a hydraulic depth of 622 ft. With this scheme some initial hydraulic potential or pumping would be necessary to secure the water circulation against friction developed in the long lengths of piping.

I am wondering whether consideration has been given to an alternative means of avoiding the civil works whilst securing the advantages of hydraulic compression. The suggestion is to use a combination of hydraulic pump and hydraulic turbine on the same shaft as a motor; the purpose of the motor being to supply the losses, the purpose of the pump to supply the head, in the example 622 ft; and the purpose of the water turbine to recover the energy of this head.

It is quite possible, of course, that the cost of this arrangement would be at least as great as the cost of the otherwise static civil works, but it is suggested as an additional subject for speculation on this new and most interesting subject.

E. A. Logan

FAREHAM, SURREY — M.Inst.C.E., M.I.E.E.

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Price-Cutting

METEOR hit the nail right on the head in "Twisting the Retail" (ELECTRICAL TIMES June 28), and my only regret is that he did not hit it hard enough. "Unrestricted competition" is a nice high-sounding phrase, but too many people, particularly those who shout the loudest, have either forgotten what it means or are too young ever to have experienced it in any real sense. Ask any of the old timers of pre-1914, when German goods were being sold below cost in order to get a footing in the market and cut-throat competition was the order of the day; what it was like trying to make a living in the electrical industry?

What our amateur economists will never get firmly into their heads is that the price of a commodity is eventually that which the buyer is willing to pay, and that economic laws cannot be set aside by Statutory Instrument, no matter how cunningly it is drafted. If the sellers—manufacturers, wholesalers, retailers or what you will—of *any* article in any industry are foolish enough to start a price-cutting war, they sooner or later go out of business. When a sufficient number of the smaller fry have been eliminated, the less-battered "big boys" call a truce, and end the price war by a "gentleman's agreement"—then raise the price to recoup their losses. In the long run, nobody is a penny better off—least of all those who have lost their jobs and, with their purchasing power diminished, contribute towards a slump. However, the ideals held forth so glibly of reducing the price to the consumer make good political capital, and that, presumably, is the real object of the scheme. If we keep our heads, we have a reasonable chance.

LONDON — *"Stability"*

New Zealand's Water Power

Progress in the Development of the Dominion's Resources

HIGHLY developed for its size and age, New Zealand, with limited coal deposits and practically no oil, is dependent, more than most other countries, on a plentiful supply of hydro-electric power. But cheap hydro-electricity too, has brought a high degree of domestic electrification. Domestic consumption is 56% of the total power sold and domestic consumers amount to over 85% of the total. More and more farmers, too, are using electric power; from 1925 to 1948 electrically driven milking machines increased from 3,581 to 35,687, and through the Rural Electrical Reticulation Council, a generous subsidy scheme enables power to be supplied to sparsely populated areas.

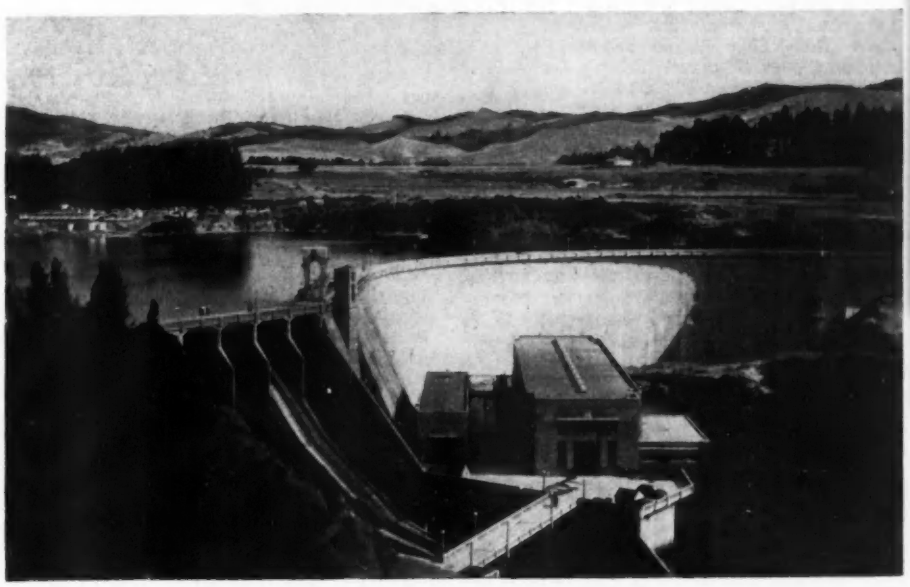
New Zealand's expanding secondary industries also are increasing the demand, and the country's transport services also need more power. Apart from the tramway systems of many of the larger towns, there is a plan for the progressive electrification of railways. Already sections of the main lines have been electrified—notably Wellington-Paekakariki, Christchurch-Lyttelton, and the Otira Tunnel through the Southern Alps. The next step will be the electrification of the suburban systems of Wellington and Auckland, and eventually the main trunk lines. Some 95% of New Zealand's electricity is generated by water power—93% being by the State Hydro-Electric Department.

The last war brought many setbacks to the country's electricity supply industry, in particular, deliveries of urgently needed plant and equipment from overseas were disorganised. When war broke out four water-turbines were being made in Belgium and Sweden for Arapuni and Piripaua. The occupation of Norway cut off the delivery of two water-turbines from Sweden, and the steamer *Devon* was sunk when bringing British parts for Waikaremoana. It was 1943 before British generators could be supplied for Piripaua, and final parts for Arapuni were held up till 1945. Now, construction on projects is speeded up.

Waikato River

It is hardly possible to deal with the North and South Islands of the Dominion in one article. The Waikato River Scheme in the North Island is probably most interesting because of its ambitiousness. The Waikato River flows from Lake Taupo, and the plan to utilise its water output comprises a series of stations down as far as the town of Cambridge. Arapuni (175 ft.) generating 145,000 kW, was completed and supplying power over twenty years ago. The new Karapiro station is

Karapiro Dam and Power House on the Waikato River



The picture on the left shows the flow from the diversion tunnel after the explosion, at the Maraetai scheme. Below are seen the housings for the concrete spillway. Across the river can be seen the site of the projected power house

between Cambridge and Arapuni. Above Arapuni on the Waikato will be situated Waipapa station (63 ft.) generating 50,000 kW. A few miles higher up comes the biggest enterprise of all, Maraetai (200 ft.) now under construction, which will generate 180,000 kW.

A Million H.P.

Just above Maraetai is Whakamaru (120 ft.) an important station, output 100,000 kW, and then farther up, Atiamuri, (120 ft.) of 50,000 kW capacity. As the river winds down from Lake Taupo above Atiamuri, comes Okakuri (137 ft.) an important station, 100,000 kW. Then above the bend of the river towards Taupo we have Parariki (35 ft.) 20,000 kW, then Aratiatia (40 ft.) 60,000 kW, while finally just below Taupo itself will be the Huka Falls station (65 ft.) 40,000 kW. When completed this water power development from Lake Taupo to Cambridge will be one of the most ambitious in the world.

Although Arapuni is nearly twice as powerful as Karapiro, built during the war for the most part, the latter has come to be a symbol of the all-out efforts made by New Zealand to catch up with the potential demand for power. Karapiro is the second of the projected 10 stations on the Waikato River, and will be followed by Maraetai. The ten stations, to produce over 1,000,000 h.p., will utilise the same amount of water as the existing two, but the present output of electric power will be trebled.

Maraetai

Work is being pushed ahead on Maraetai, which will be New Zealand's biggest power station, until the construction of Roxburgh and Enmore in the South Island. If there are no serious hold-ups in labour and materials it is hoped that Maraetai will be in operation by the winter of 1952. It is to have a 280-ft. high arch dam. There will be five 36 MW main generators with two 750 kW auxiliary units. The five pen-stocks will be 16 ft. in dia. and 250 ft. long. The diversion tunnel will take the full flow of the Waikato River for the next two years, while the 450-ft. long dam is being built. Work has already begun on the site of the next station, Whakamaru, eight miles upstream.

South Island

Of the South Island schemes in process of construction, the Roxburgh hydro-electric station, with four sets totalling 160 MW, is the major project. For this, as with many other of New Zealand's power schemes, much of the plant is being obtained from Britain.

Notes on Wiring
by **MEGOHM**

AT BRIGHTON

A Contractor's Convention Conclusions

BRIGHTON "B" generating station was open for public inspection on Thursday during the British Electrical Power Convention, and one question asked was why it was necessary to cover the walls with tiles.

One lady appeared not to be satisfied with the guide's explanation that tiles were fitted to enable the station to be maintained in a clean condition with the minimum expenditure on materials and labour. I believe this lady was concerned that in her new house she could not have tiles fitted in the bathroom and kitchen, and since electricity was so clean, surely tiled bathrooms and kitchens should be considered of at least equal importance. Most of us will agree that the fitting of tiles in stations, bathrooms and kitchens is good practice, and sympathise with our lady critic.

In view of the progress made on finishing work on the first section of the power station turbine house and the tiling of the walls and columns being well on the way to completion, it was a little surprising to see no signs of the wiring installation for the general lighting and auxiliary power point services. The contract for this section of the work, it appears, has only recently been placed, and therefore much of the wiring work will now have to be run on the surface of the ceilings and walls. This surely could have been avoided by advanced planning, which would have enabled the conduits to be concealed within the structure of the building, providing a far cleaner job, since no matter how well conduits are run on the surface, they provide ledges for dust and grime. Further, a properly designed installation concealed in the structure not only provides for a pleasing installation, but also reduces the cost of the work.

Installation Exhibits

A quick look round the B.E.P.C. Exhibition in the Floral Hall was sufficient for me. The stands on top of each other, the crowded, narrow passages and the heat made me glad to be on the front again and on my way to the Grand Hotel, where an exhibition, "Electricity in Industry," organised by one of the cable makers, was in progress. On display here were manufacturers' products associated with the erection of a new general rubber factory at Brynmawr in South Wales. Among exhibits of interest to installation engineers was an electronic insulation tester, which I am told is suitable for carrying out insulation and pressure tests up to 3·3 kV in compliance with B.S. 480:1942. This equipment is robust and compact and can be easily carried around.

Other exhibits on view included lighting fittings, switchgear motors and motor starters, power factor correction equipment, underfloor ducts, cables, copper busbars and cable cleats. The layout of the exhibition was well planned and provided space for viewing the exhibits in comfort.

Home Wiring

On to our general walk-round stores, where I saw an array of switches, switch sockets, ceiling roses and lampholders, and an instruction leaflet headed "Hints for Users of Flexible Conductors" caught my eye, especially as reference was made that rules governing the installation of electrical fittings could be obtained on application to the local electricity office, and it was strongly recommended such rules should be carefully followed.

Advice that the human body is sensitive to electric shock is given, and the leaflet goes on to say special precautions should be taken with the wiring and use of electrical appliances in cellars and under humid conditions. Further, no portable appliances, including radiators, should be placed in bathrooms.

I cannot believe the British Electricity Authority subscribe to this form of trading and installation work, carried out no doubt in many cases by inexperienced people and over which the Authority has little control, since such work is usually installed after the installations have been connected and in service for some time.

May I suggest the British Electricity Authority should disassociate themselves very positively from such forms of trading, and the unqualified should be discouraged from endangering the lives of the innocent.

Manchester's *DIGITAL COMPUTOR*

Commercial applications in addition to mathematical research are possibilities for this latest electronic calculating machine

TWO 12-digit numbers added together in 1·2 milliseconds; multiplied together in 3 milliseconds; and a memory of 650,000 binary digits immediately available. That is the brief specification of the Ferranti High Speed Digital Computor, which was demonstrated last Friday in the new computing laboratory at the University of Manchester. Electronic computing machines are becoming increasingly familiar as a name to engineers though it is probable that most have yet to see one, and so a very general description of this beautifully engineered design is likely to be of interest.

The two rows of racks seen here are the air-conditioned compartments containing the main memory and staticisors (nearer camera) and the arithmetic units and magnetic memory

The appearance of the machine is well shown by the illustrations: there is a control console housing the necessary switch keys, c.r.o. monitoring displays, and the means for feeding information to, and receiving it from, the machine; and behind this are two rows of vertical cabinets containing the electronic and magnetic equipment involved. These are supplied with carefully conditioned air to ensure maximum stability of the circuit components.

Information and instructions are fed into the machine by means of a teleprinter punched tape, and the output is obtained as a similar punched tape, or is typed directly. The machine can perform all the operations carried out by the human computor, provided that it is given precise instructions on what to do at each step: the art of preparing such a programme can be learned in a few weeks by an ordinary mathematician, though it is novel and rather difficult to pick up at first.

In common with most similar machines, the Ferranti computor works with the binary system, in which decimal numbers are replaced by powers of two—e.g. 11, which is $1.2^3+0.2^2+1.2^1+1.2^0$ is taken as 1011. The advantage of this system is that any digit is either present (1) or absent (0), and can be represented in a chain of pulses in a corresponding way. This idea of a chain of pulses representing a number is widely used in the machine, and so the first requirement is a common time base available throughout the circuitry. This is provided by a 100 kc/s crystal controlled operator, arranged to produce successions of 24 ten microsecond pulses. The significance of the presence or absence of a pulse is always read with reference to this 240 microsecond period.

Memory

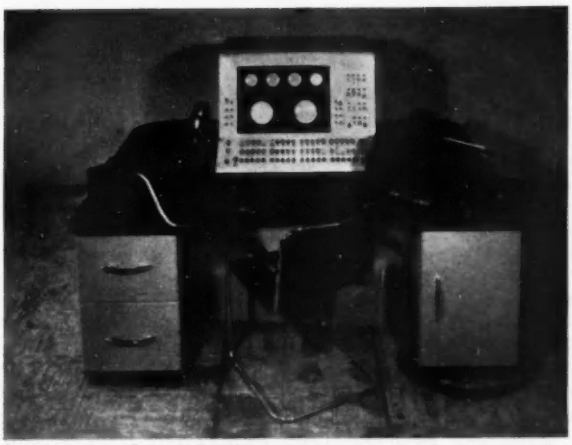
Probably the most important part of the machine is its high-speed memory. This is of the c.r.t. type developed by Prof. F. C. Williams of Manchester University, the numbers being stored as dots on the face of a cathode ray tube. A pick-up plate is provided in front of the tube, and as each spot position is bombarded by the scanning beam a positive pulse is, or is not, electrostatically induced according to whether

that spot has, or has not, been bombarded previously.

Of course, one of the many complications is that this memory must be continuously renewed, or the spot charges will leak away, so the tube face is continuously scanned. Each spot position is first "looked at" by a defocused beam, which notes if it was bombarded before. If it was, then a finely focused pencil of rays is directed on the spot to replenish the charge. Similar methods permit reading of the stored numbers.

In the machine, the face of a single c.r.t. holds 64 lines, each of which contains 20 spot positions. A spot of about 0·1 mm dia. is standard, necessitating a special "gun" and a voltage of 1·2 kV. In any 240 microsecond period, 200 microseconds are devoted to reading a line, and 40 microseconds to flyback. Eight main c.r.t. stores are incorporated in the machine.

Further memory facilities in a more permanent form are provided by a main magnetic store, consisting of a drum, 6 in. in dia. and 8 in. high, with is surface coated with 0·001 in. nickel. On this surface 256 tracks can be recorded, and each track can hold two of the 1,280 digit totals from a main c.r.t. store. This gives a total permanent storage of 650,000 binary digits, or about 200,000 decimal digits. The advantage of the c.r.t. stores is that access to them is possible in 200 microsecond, whereas access to the magnetic stores takes the relatively long period of 30 milliseconds. To work successfully, the drum has to rotate with a surface speed of 30 m.p.h.



On this control console, the two large c.r.o. tubes permit the operator to monitor any two of the main store tubes, while the smaller tubes show the state of selected parts of the memory

Basic Circuits

Four kinds of circuit are used in the arithmetical operations of the machine. First of all "gates" of valve circuits performing the function of an ordinary relay. They either do, or do not, pass through a chain of pulses. These may be "or" gates, which will pass the signal if an appropriate pulse is applied to any of the valves comprising the gate, or "and" gates, which will only pass the signal if appropriate pulses are applied to all the valves comprising the gate.

In adding circuits, say for two numbers, the pulse chains representing the numbers are fed in at the same time (the 240 microsecond sequence provides control) to gates in parallel; if two pulses arrive together (equivalent to "carry one" in the binary system) a pulse is put into a delay circuit, and fed back 10 microseconds later in the next digital position. For multiplication, one of the two numbers concerned is fed into a separate store, and is then multiplied digit by digit by the other number, in a long multiplication procedure with simultaneous addition. Here the binary system comes into its own, because each partial product is either zero, or else multiplied by a power of two—i.e., shifted some places to the right. Delay circuits can again take care of this operation.

Staticisors

When it is necessary for the machine to remember some information for a considerable period of time, the usually dynamic pulse-chain can be "frozen" in so-called staticisors. Each possible pulse is represented in the staticisor by a flip-flop circuit, the state of the valve-pair indicating the presence or absence of the relevant pulse. By suitably connecting these valves in further combinations it is thus possible to arrange that any one chain of pulses can be directed through the machine in a manner determined by a preceding pulse chain.

Operation

Now that the components of the machine have been very briefly described, it is possible to examine how it is organised. First of all, the selection of a number from the c.r.t. store. Groups of staticisors are set up which define the tube on

which the required number is stored, and the line which it occupies. The next pulse chain can then read off the number required and pass it, through another set-up staticisor, into the arithmetic unit, where some succession of operations can be performed upon it. The results of each arithmetic operation are placed on a special line in the store—the accumulator—and put back into the main store in a separate operation.

One c.r.t. store is used to "control," the machine, and contains the instructions necessary: (1) pulse chains from lines in this tube are used to select, via staticisors, a particular line in the main store. This line will contain the instructions next to be obeyed, and is copied (2) into a special "present instruction line." This "present instruction" is then read out again (3), and it sets up the necessary staticisors to open appropriate gates, choose the number on which the operation is to be performed, and route it to the required destination (4).

During operations (1) and (3) the main stores are not required by the machine, and the time available is used to regenerate them by scanning line by line. This is one advantage of writing information in an intermediate operation; another is that fewer valves are required, since the staticisors can be reset for a new routing. Three sets are used—"function," "tube," and "line," and these perform the operation which their names indicate.

In practice, it is necessary to enable the machine to perform one sequence of operations several times on a succession of different numbers, and to endow the machine with a judgment of its own—e.g., between positive or negative numbers. This greatly modifies the limiting effect on speed of tape punching. Further economy in time and effort is obtained by permanently storing on the magnetic storage drum, sub-programmes for commonly required processes such as extracting roots or finding the sines of angles.

Checking and Application

The machine contains in all some 2,000 valves, and all of these, of course, present some potential faults. A routine has, therefore, been incorporated so that if anything goes wrong (as indicated by mathematical auto-check routines) a test programme is automatically put into operation which shows by a display on one of the control console monitor tubes, the actual valve which is the seat of the trouble.

Much engineering work is continuing to improve the speed and convenience of these machines, but increasing importance is being attached to the finding of everyday tasks which they can perform more economically than existing mechanical aids to computation. Such matters as commercial accounting on the largest scale, transmission network analysis and machine design for economy in materials at once come to mind, and these and others are being examined by a special team of engineers and mathematicians at Messrs. Ferranti's works.

INDUSTRIAL SHOWROOMS IN LONDON

AN opportunity has been taken of providing a showroom for industrial electrical equipment when the London Office of the Electrical Construction Co., Ltd., was moved last week to Bushbury House, Buckingham Gate, S.W.1. This showroom is conveniently situated in Victoria Street area and will display the more recent electrical equipment and specialised applications. It will thus form a convenient centre for consultation on all industrial problems with the opportunity of seeing at first hand the characteristics of the basic equipment. At the formal opening of the showrooms last week there were to be seen examples of industrial switchgear and the "Varispeed" system of speed control of motors. The more recent entry of this firm into the electronics field was indicated by a moisture meter which is being used for the automatic control of speed of weaving machines in accordance with the moisture content in the textiles.

At a luncheon which followed the opening, Mr. W. M. B. Furniss, Assistant Managing Director, welcomed the visitors, pointing out that the original firm was formed as long ago as 1882, while the first London Office was opened in 1894. He went on to give some particulars of the long and interesting history of the company. In the early days they manufactured a wide range of electrical equipment, but by 1904 they had concentrated on electrical machinery and switchgear. It was in the slump of the 1930's that the firm recommenced the manufacture of transformers, and this was later followed by the introduction of rectifiers as a complementary product to rotating machinery.

The reply on behalf of the guests was made by the Rt. Hon. the Earl of Verulam. Finally, a special toast was drunk to Mr. Furniss, senior, who has been responsible for the management of the company since 1915. Mr. Furniss replied by recounting some amusing incidents of early times.

Problems and Practice
IN ENGINEERING

Thermal Trouble

RECENTLY I have had several calls to a 10-h.p. d.c. motor, which failed to stop when the operator pressed the stop button on closing down at lunch time. Each time he opened the main switch and informed us of his trouble on his return to work.

On each occasion I examined the control panel and found no apparent trouble, furthermore, I never had the fault occur while I was present. As this was most unsatisfactory, I asked the operator to inform me immediately the next time the fault occurred. The result was as follows:

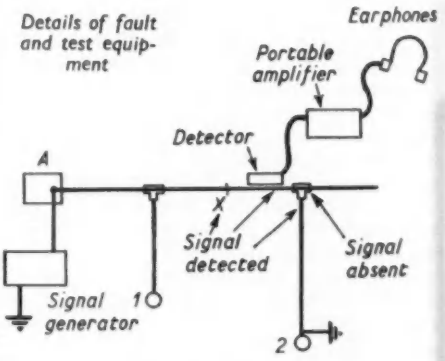
On opening the contactor panel I found the main contactor still in, although the main switch in the 500V supply was off.

The cause of the trouble was that the nut on the stud at the back of this panel-mounting contactor was loose, causing a high-resistance joint and consequently heat. The heat in turn expanded the swivel pin of the contactor and seized it solidly in the in position. No doubt had the operator called us immediately on the previous occasions instead of waiting until after lunch, this would have caused less trouble. —*A. W.*

Fault Location on Low Tension

FAULT locating on low-tension distribution cables can be very often difficult and costly. This is due mainly to the fact that a straightforward test, such as the "Murray Loop" is impossible because of the varying resistance of consumers tappings and the common practice is to "cut and test both ways" until the field is narrowed sufficiently either for the location of the fault to be deduced or for the service fuses to be withdrawn and a bridge test carried out with a minimum of interruption to consumers. A recent fault concerned the fifth core of a 500 yd distributor, which fed seven street lamps.

A "Murray Loop" test was impossible without making the whole cable dead and the measuring of resistances by a bridge circuit was unreliable as the galvanometer was sensitive to potentials on the neutral and the lead sheath. This actually gave a position X ten yards from lamp 2, the inaccuracy later being attributed to the possible variation in resistance of the earth return at lamps 1 and 7. To finally locate the fault without resorting to cutting the cable, the ground was taken out and the cable



uncovered at the point X indicated (where there were signs of recent disturbance) and also at the tee-joint feeding a crossroad service to lamp 2. An S.T.C. detector was then used. The signal generator was connected to the faulty core in link box A and to earth. Using the detector, amplifier and headphones the signal was picked up at the point X and at the tee-joint. It was, however, only on that side of the tee nearest to where the signal was being injected and it was also on the lamp service cable. The test repeated from another link box similarly indicated the fault to be on the service cable.

This seemed conclusive that the fault was on the lamp service. Subsequent excavation proved that this was so, the core having burnt through and "earthed" to the lead sheath at the entry to the standard. The use of the detector enabled the fault to be located accurately and certainly without any cutting of the cable or interruption of consumer service. This was made easier by the low resistance of the fault to earth, but it should be possible with a higher resistance fault to work similarly, detecting difference in strength of signal if not complete absence. It should be noted that the signal generator is connected

directly between core and earth and not core and neutral, which would enable the signal to be picked up at any point along the cable.

Cable Fault Location

THE technique of cable fault location would be straightforward if the perfect conditions so often assumed in text books prevailed. They are, however, seldom present, and it is then that the ingenuity of the test engineer may save many hours of delay in restoration of supplies and achieve considerable economies in the cost of repairs.

For instance, a fault developed on an 11-kV 3-core 0·06 sq in. pilcdsta cable only 335 ft long, connecting a ground transformer to an overhead line. Tests with a 1,000V megger showed two cores well down to each other and about 70,000 ohms to earth; the remaining core was sound.

A Murray loop test was applied, but due to the damping effect of the short cable, it was difficult to pin-point the balance and the location could only be given as approximately 10 ft below the pole box. The cable down the pole was, therefore, thoroughly examined, but no damage could be found. A bridge megger was then connected between a faulty core and earth, and a balance obtained which fortunately remained steady. The test was continued whilst a blow-lamp flame was slowly passed along the cable. On passing a point quite near the above location, the balance of the bridge was violently disturbed. The steel tape armour and other protective coverings were removed at this point and a small hole was found in the lead sheaf resulting from an internal fault.

The cable was cut just below the fault and sufficient slack was gained at the base of the pole to enable the pole box to be re-made.—*B. L. Stanforth, A.M.I.E.E., Folkestone.*

Static and Insulation

THE letter from W. H. Rees (May 17, 1951) reminds me of a somewhat similar incident which occurred a few years ago. The boiler attendant complained that he had received a nasty shock when he touched a switch fixed to an iron staircase leading to the top of the boiler. On inspection, the switch was found to be solidly earthed by the conduit and the boiler steelwork, and no shock was experienced, which fact was demonstrated to the boilerman to his satisfaction, though he still maintained he had had a shock off that switch.

Half an hour later my 'phone bell rang and the language which came over would have put any trooper to shame. In the intervals of more or less coherent English, I gathered that that so-and-so switch had again "kicked" him. Again I cautiously approached the culprit, flicked it, grabbed it, shook it, and almost bit it, to convince our boilerman that he couldn't get a shock from it.

By this time we had been joined by the boiler-house superintendent, and the three of us stood talking about various strange experiences of electric shock. After a minute or two the boilerman left us to make an adjustment to a valve and then returned and again joined in the conversation. The boilerman and I stood with our hands in our pockets and quite close together. Suddenly there was an ominous crack and we both jumped, a spark having passed from his hand to mine. I looked at his feet. He was wearing rubber boots and the mystery was then solved.

Apparently it was his routine to make an adjustment to a valve on the ground floor and then dash upstairs to adjust another valve. In adjusting the first valve his body was exposed to a h.p. steam leak from another valve gland, which apparently charged his body, and his first contact with earth was when he put his hand out to grip the stair rail which had the switch fastened to it.—*S. G. H.*

The next problem has been selected from this week's postbag of technical queries for the Electrical Times editorial staff. Readers are invited to submit their own solution: any replies printed will be paid for at our standard rates.

Flywheel Effect

I HAVE a small but troublesome problem for which some other reader of the Electrical Times may suggest a solution. The retort charging machine at the works where I am maintenance electrician consists of a 5 ft diameter enclosed fan. The drive for this is a 15 h.p., 220 V d.c. compound motor with a variable shunt resistance for speed control.

Owing to the flywheel effect of the fan, at each slowing down operation the back e.m.f. of the motor raises the feed trolley wire voltage to 400 V, approximately, with results disastrous to the lamps on the local lighting circuit of the machine. The trolley wires are fed either by a 220 V mercury arc rectifier, or by a gas engine driven generator. The problem is how to stabilize the lighting circuit voltage, since the circuit cannot be reconnected elsewhere. Voltage relays are unsuitable, due to excessive vibration and dirt. Could some form of non-linear resistor be used?—*R. Steed.*

FUEL IN THE HOME

Domestic Expenditure on Electricity, Gas, and Coal Analysed

DATA on domestic utilisation of electricity is difficult to obtain, although it is needed as a link in many estimates in distribution planning and in sociology. Researches by Mr. Schiller and his associates under the auspices first of the E.R.A. and now of the B.E.A., have bettered the position and from time to time various Governmental reports have appeared which give some indirect information on this matter, latest of these is a Central Office of Information Social Survey document "Domestic Utilisation of Heating Appliances and Expenditures of Fuels in 1948/49."

In examining the various statistics given in this survey it is necessary to keep in mind the circumstances in which they were collected. The sampling survey which was the occasion of their being obtained, was designed with another object in view, the fuel consumption figures being a by-product. Moreover, since a sample of 2,600 households was taken to cover the whole of Great Britain, there is a considerable margin of error in some of the sub-classifications of the data. However, some cross checks are possible, which suggest that the figures present a reasonable estimate.

Saturation

First, as to overall figures. It is esimated that at the time of the survey, 7% of the households in the country had only solid fuel apparatus for heating and cooking, while another 13% had a mains gas supply, but no electricity. 14% had an electricity supply without gas (consumer generated electricity is excluded) and the remaining 66% had both gas and electricity.

When the living-rooms of these households are considered, it is found that 96% have an open coal fire available—not necessarily used—and 2% other coal fires. Other estimates are electric fires, 5%; gas fires 1%; central or district heating 1%. The total is 106% because 6% of the houses had more than one means of heating available. Corresponding figures fo the principal bedrooms are 76%, 13%, 11%, and 1%, with 1% as "other means" and 5% of the households having no heating in the bedroom.

Table 1 shows the overall picture of possession of gas and electric appliances. Comparison with previous years is not possible with the figures available to the Social Survey, but it is suggested that there had been a great increase in gas and electric heaters since 1942, and that they were used not merely to replace coal, but also for short period heating in rooms which would not otherwise be heated.

TABLE 1.—Gas and Electrical Appliances in Households

	Proportion of households which have appropriate supply and possess		Proportion of all households which possess	
	Gas	Electrical	Gas	Electrical
Cooker	85	17	67	13
Portable fire	10	58	8	46
Fitted heater	17	5	14	4
Sink waterheater	7	2	6	2
Multipoint	3	1	2	1
Immersion	—	10	—	8
Bath geysers	10	—	8	—

In interpreting the saturation figures from the loading viewpoint, it has to be remembered that in the winter months in some households solid fuel appliances are used for all purposes. From the part of the survey taken in November, 1948, it is found that only 91% of the households possessing an electric cooker had it in use.

TABLE 2.—Average Annual Domestic Expenditure on Fuel

Income Group *	All fuels	Solid fuels	Electricity All users	Electricity No gas	Gas All users	Gas. No electricity
	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
Up to £3	14 12	8 19	3 15	4 14	5 2	5 6
£3-£5	17 14	9 6	5 6	6 16	7 7	8 1
£5-£7 10s.	20 2	9 6	5 16	9 3	8 2	10 3
£7 10s.-£10	23 18	10 2	8 13	12 12	8 12	10 19
£10-£20	27 8	11 2	9 16	16 4	10 6	13 16
Over £20	35 8	13 11	18 4			
No answer	23 6	9 12	8 19	10 9	8 18	12 8
	20 18	9 13	7 0	9 17	8 1	9 0

* Income group for the purposes of this survey was the weekly net income of all wage-earners in the household.

Expenditure Statistics

When expenditure figures are involved, the disadvantages of working from a sampling survey planned for another purpose becomes especially apparent. An immediate difficulty is that the figures for electricity expenditure include money spent on lighting. With these reservations, Table 2 shows estimates of expenditure. In reading this, the variation in availability of electricity appliances has to be borne in mind, so that no simple interpretation can be placed upon the fact that "all electric" households have an average expenditure of £9 17s., against all gas" households averaging £9. In general, gas cookers are more evenly distributed amongst all income groups.

Further tables in the survey analyse domestic fuel expenditure with reference to number of rooms, rateable value, and number of persons in the household. Then come two more tables, shown combined in Table 3, of more particular interest to the supply industry: they break down the averages by town and country, and by geography, respectively. One aspect of the rural figures needs comment: the overall average is lower because in only 241 out of the 387 households included was some form of non-solid fuel available: electricity was available in 206 cases.

If the households with gas and/or electricity available are considered alone, it is found that in nearly all cases the expenditure on either gas or electricity where only one of these supplies is available is greater than the combined expenditure when both are available.

TABLE 3.—Average Annual Domestic Expenditure on Fuel by Area of Residence

	All fuels	Solid fuels	Electricity All users	Electricity No gas	Gas All users	Gas No electricity
	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
Urban	22 0	9 10	6 16	10 3	8 0	8 19
Rural	17 4	10 3	8 6	9 10	8 12	9 8
Urban Areas S. and S.W.	23 1	8 0	7 0	17 5*	10 17	11 18
London, S.E. and E. ...	25 3	8 18	7 14	11 14	10 12	11 14
Wales, Mids. and N. Mids.	21 10	10 8	6 9	9 6	7 1	7 0
N., N.W. and N.E. ...	19 8	9 15	6 8	8 15	5 13	7 10
Scotland	19 19	10 8	5 4	9 13*	5 12	5 13

* Averages based on less than 15 cases.

Consumption

An important part is played by tariff structure. The upper income groups paid at the time of the survey 1·12 pence/unit, while for the lowest group the comparable figure is 1·94.

TABLE 4.—Average Consumption of Gas and Electricity

Income group	Electricity (No gas) Units	d./unit	Electricity (Gas and elec.) Units	d./unit	Gas (Gas and elec.) Therms	s./th.
Up to £3	580	1·94	410	1·95	67	1·49
£3-£5	1,050	1·56	560	2·05	103	1·38
£5-£7 10s.	1,600	1·73	610	1·87	110	1·39
£7 10s.-£10	2,310	1·31	1,210	1·50	126	1·30
£10 and over	3,270	1·19	1,310	1·73	135	1·47
No answer	2,030	1·24	1,080	1·88	118	1·34
	1,760		850		113	
Urban	1,860	1·31	840	1·79	113	1·37
Rural	1,630	1·40	870	1·81	112	1·47

Table 4 shows the effect of this variation when an analyis is based on income groups.

ULSTER'S ELECTRIFICATION PROBLEM

ALL rural electrification in Northern Ireland is to be carried out by erecting single-phase extensions, 3-phase being only employed where the load demands it or the consumer is prepared to pay for it, stated Sir William Robinson, chairman of the Electricity Board for Northern Ireland, recently. He was dealing with the 19th annual report of the Board—just issued—in which it is shown that heavy losses had been suffered on rural electrification, and further losses were expected. Sir William pointed out that the Board had spared no effort in carrying out the request of the Government that rural electrification should be carried out to the fullest extent of availability of materials. Indeed, the target for 1950 had been exceeded. Rural schemes had been approved, representing an estimated expenditure of £1,700,692 to supply 3,712 farms, 5,824 rural and 510 miscellaneous consumers. But the revenue return from most farms converted was most disappointing.

The Board considered it wrong to incur heavy capital costs and use scarce materials such as copper, steel, lead and zinc in providing supplies to consumers who only intended to use it for light and radio.

Mr. A. W. Ferguson, the Board's chief administration officer, stressed that the present average return on rural expenditure was only 6½%, but to make ends meet the Board required at least 21%. In Eire, the government provided a grant of 50% of capital expenditure, and he thought that only three courses were open to the Ulster Board: (1) to get a Government subsidy; (2) to raise tariffs, and (3) to increase charges to farmers.

During 1950, the number of units sold by the Board, was 252 million, an increase of 15.7%, according to the report. Revenue also jumped 15% to £1,668,583, while expenses rose by 18% to £1,349,762, leaving a surplus of £884. A further 8,299 consumers were connected, bringing the total to 100,885.

Fortunately placed, in regard to power cuts, a new generating set went into operation at Ballylumford during the year, and another is soon to be working in Belfast. These, together with the new power station to be erected at Belfast Harbour, which, it is hoped, will be ready by 1953, should help in reversing the present position where consumption was overtaking plant availability. But Sir William gave a final note of warning that, with rising costs and wage claims, it may soon be necessary to increase tariffs.

Fluorescent Lamps on D.C.

Practical Values for Ballast Resistors

By W. A. R. STOYLE, B.Sc., A.M.I.E.E., F.I.E.S., and G. D. JONES-THOMAS, F.R.S.A.

THE hot cathode fluorescent lamp is designed primarily for use on alternating current, as is evident from its symmetric construction. Such lamps can also be operated on direct current, but it must be appreciated that by so doing certain limitations and disadvantages are incurred. Although d.c. operation cannot be regarded as giving a similar order of light production efficiency as that on a.c., nevertheless, it offers an appreciable advantage in this respect over the alternative tungsten filament lamp.

There are, however, many lighting applications where the unique characteristics of the fluorescent lamps more than outweigh the loss in overall efficiency resulting from the resistive stabilisation which the d.c. fluorescent lamp circuit requires.

When fluorescent lamps are used on d.c. a resistance of appropriate value and rating must be connected in series with each lamp. This resistance is in addition to the normal choke coil used on a.c., which must be retained in order to provide the induced voltage surge necessary for starting the lamp.

The recommended values of these resistances for different sizes of fluorescent lamps together with their current rating is given in Table 1.

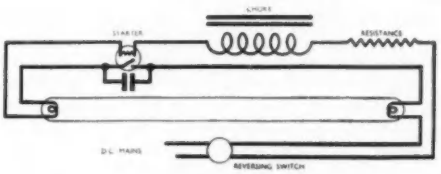


Fig. 1. Typical diagram of connections

One of the characteristics of fluorescent lamps operated on a unipolar supply is the migration of ionised mercury vapour to the negative electrode with consequent darkening and loss of light at the anode end of the tube.

Fig. 2. (on right) Recommended pattern of reversing switch.

Fig. 3. (below) Typical ballast resistor unit

This end darkening effect is more rapidly apparent with the longer fluorescent lamps and provision for reversing the polarity must be made. It is convenient to use a rotary on-and-off reversing switch for this purpose as reversal can then take place every time the lamp is switched. Common types of enclosed resistances and rotary reversing switches are shown in Figs. 2 and 3.

The usual circuit for operating a single fluorescent lamp on d.c. is illustrated in Fig. 1. It will be noted that a thermal type starter switch is used. This is recommended as most glow type starter switches are asymmetric in construction and will not operate equally well with either polarity.

It is difficult to give any definite recommendation as to the period of reversal as this varies somewhat between lamps of different lengths and even between lamps of the same length. In general, however, the 5 ft. 80-watt lamp will require reversal about every six hours, but the shorter lamps such as the 2 ft. 20-watt may operate satisfactorily up to 24 hours on the same polarity.

TABLE I
D.C. Operation of Fluorescent Lamps. Resistance Values in ohms

Mains Volts	*5 ft 80 W*	*4 ft 40 W*	*3 ft 30 W*	*2 ft 40 W**	*2 ft 20 W**	*18 in. 15 W**
200/210	103	202	260	108	166	214
220/230	131	250	335	131	224	298
240/250	159	300	414	159	298	376
Nominal lamp Current (amps.) ...	0·7	0·34	0·27	0·76	0·31	0·25

*Two lamps in series

TABLE 2. EFFICIENCIES

Rating	Average Lumens throughout life	Gear Losses Watts (230 V) a.c.	Gear Losses Watts (230 V) d.c.	Effective Service Efficiency L/W d.c.	Effective Service Efficiency L/W a.c.
5 ft 80 W day light	3040	81	12	18·9	32·9
4 ft 40 W day light	1720	38	12	22·1	32·9
3 ft 30 W Natural	1080	32	10	17·5	27·0
2 ft 20 W Natural	1120*	31	12	15·8	21·5

*Two lamps in series

Starting is more difficult on d.c. than on a.c. due to the absence of the a.c. peak voltage and the use of 5 ft. 80-watt lamps on supplies likely to fall below 200 volts is not recommended. The 4 ft. 40-watt and shorter lamps, however, need no such stipulation. Stroboscopic flicker and power factor correction problems are, of course, absent on d.c.

Before much experience in the use of fluorescent lamps on d.c. had been gained, it was thought that the life of such lamps would be affected. However, it would now appear that the average life is comparable with that on a.c. under the same operating conditions.

So far as economic arguments are concerned it is clear that it is hard to justify the use of fluorescent lamps on d.c., but the real value of fluorescent lighting cannot be assessed solely on an economic basis.

Table 2 shows a comparison between fluorescent lamps of different ratings operated on 230 volt a.c. and d.c. supplies. The "effective service efficiency" has been taken as the average lumen output throughout life divided by the total watts (lamp and gear) consumed.

It will be noted that the effective service efficiencies of the d.c. circuits are only about 50% of the a.c., but there is still a gain of some 50% over tungsten filament lamps of comparable wattage.

Steam Valve Productivity

United States practice shows few differences from this Country

DIFFICULTIES in securing steam valves for the power station constructional programme give the supply industry a special interest in the latest report issued by the Anglo-American Council on Productivity. This records the conclusions reached by 15 members of the British Valve industry who spent six weeks in the United States during November and December of last year. Additional interest is given to the report by their being one of the first of the productivity teams to make a close study of machine shop practice.

Average productivity in this branch of U.S. industry is reckoned as higher, but less than double, that in Britain. No single reason is selected for this better rate, but 13 recommendations are made to help improve matters in this country. First place is given to the need for more mechanical handling, and in particular palletisation. Further to this, machine utilisation can be increased, especially by more extensive use of effective jigs and fixtures, and by the widespread introduction of air and electric trucks. Special purpose and multi-operation machines have much to recommend them, even when they are expensive in first cost, and the more widespread use of power devices such as air or electric impact wrenches is worth close attention.

An outstanding difference between the U.K. and the U.S. was found in the technical education which the staff had received. The greater proportion of professional engineers, technicians, and draughtsmen in the U.S. industry made possible fuller attention to the engineering of a job right the way through.

These and other summaries of opinion are backed up in the body of the report by details of the evidence on which they are based. As a background to these examples, however, it is emphasised that a large number of the machine methods seen in the United States, together with the tooling and cutting feeds and speeds, are similar to those in common use in Great Britain. Yet American overall productivity is greater than British.

Amongst points of difference specially picked out for mention are, the custom of local rather than national union agreements, with resultant simplicity; an understanding attitute of employees to profits, an absence of any apprenticeship system, or bar to entry into a trade; and a closer personal contact between top management and the men in the workshops.

The report, which bears the title "Valves, steel, iron and non-ferrous" is published from 21, Tothill Street, London S.W.1, price 3s. 6d., post free.

RESEARCH AT STOCKPORT

Opening of the New Simon-Carves Laboratories

A general view of the new buildings. The main Simon-Carves laboratories block is on the left, and behind it are further laboratories and the Development building. The tower contains the Henry Simon experimental flour mill

OVER three hundred visitors were present at the official opening of the new research and development buildings of the Simon Engineering Group, on Tuesday of last week.

Proposing the toast of "The Guests" at the inaugural luncheon, LORD SIMON OF WYTHENSHAWE pointed out that the firm was now in its third generation, having been born in 1879. Reviewing generally the achievements of the firm, he pointed out that there was now an order book approximating £50 million, and outlined the heavy programme including some £6 million in export power station contracts alone.

Home and export markets depended upon one another, he said, and neither could, by itself, support an organisation of the size of the Simon group—a size which was essential if they were to undertake research and development on the scale which was needed. Exports demanded the enlarged scientific staff and resources to provide the necessary know-how as well as a good home market in which plants accessible for operational study could be built. He hoped that the nationalised industries would not be tempted to design and build their own plants, which would cut down the home market which was the essential foundation.

Need for Research

Reply was by SIR HENRY TIZARD, G.C.B., A.F.C., F.R.S., Chairman of the Advisory Council on Scientific Policy, who formally declared the new laboratories open. On the general question of research, he said that there was often a feeling that only large concerns could afford to indulge in it. This was quite untrue—actually, he believed that no firm was too small to afford research, even in the smallest way. It was one of those things which might be enlarged and expanded, but it was something which could never be given up.

To attain one's aims research must often be instigated outside normal terms of reference, said Sir Henry, and he instanced the gas turbine, the internal combustion engine and the coke oven as examples of fields in which, to attain any real improvement, one was forced to revert to scientific research in the real sense of the word.

In this country, the public was inclined to regard science as something for the tools of war or the playthings of civilisation, such as television, and he did not feel that there was any real general appreciation of what science really meant. Leisure itself was a result of the direct application of science, and the advance of civilisation depended upon the rising productivity of labour, and it was not only in our own interests but in those of backward nations to extend to them the knowledge that laboratories such as the new Simon Carves foundations made available.

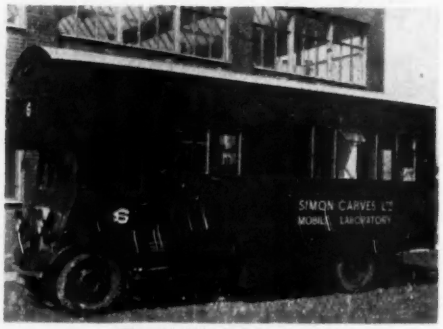
The Laboratories

The new laboratories are located at the Cheadle Heath (Stockport) headquarters of the Simon Engineering Group, the principal divisions of which are Simon-Carves Ltd., Simon Handling Engineers Ltd., Henry Simon Ltd., and Turbine Gears Ltd. They centralise, in effect, research and development work which was formerly scattered over some 80-odd acres, in a single block of modern buildings, providing improved facilities and accommodation for a larger staff of research workers.

The broad main fields covered by the research and development department are coal cleaning, carbonisation, treatment of coal by-products, fuel combustion, steam generation, electrostatic precipitation, pneumatic and mechanical handling, flour milling, sulphuric acid production and gasworks ancillary processes.

In the research department itself, work is broadly sub-divided into mechanical and chemical testing, research, and information. In the field of coal utilisation alone, for example, no fewer than nine laboratories are devoted to the preparation of samples, "washability" tests, examination of coking qualities of coal for carbonisation, and the calorific value, ash fusion, and grindability of boiler fuel coal.

In research proper, as distinct from testing, an interesting field for study is provided by electrostatic precipitation as affected by migration velocities, wave forms of applied voltage and corona discharge. This, of course, is an example of the more fundamental or long-range project. One of the country's major problems being tackled on an immediate basis is the supply of sulphur for sulphuric acid production. Among the



The Mobile Laboratory

sources under consideration are recovery from waste and flue gases, removal from towns gas, flash roasting of iron pyrites and the micro-biological process.

Information is dealt with by a library and a separate Information Section, the latter dealing with the less straightforward type of query, which may involve extensive search for the data required.

Adjoining the laboratories themselves is the Development Building. Unlike research, which is more centralised, development is dealt with departmentally, and the building provides facilities for the erection of pilot plants to study new processes. The Power Plant department is studying characteristics of fuels, carry-over of solids in steam, heat transmission, boiler circulation, tube expansion, etc., although some of the work is not yet in full swing. Amongst future projects are a combustion pot to determine the behaviour of solid fuels on travelling-grate and spreader stokers, and a new type of pulveriser.

Amongst other items of interest was a mobile laboratory completely equipped with test apparatus and instruments for site investigations on commercial plants.

Mechanical Erection of Overhead Lines

THE increased speed and possible savings in labour by the use of mechanical aids to hole-digging and pole erection have often been pointed out, a recent example being the report of the Anglo-American Productivity Team for the supply industry. While there is some use of heavy American machines which were brought over by the Canadian Army during the war, these are not always suitable for the terrain encountered, and the alternative is, generally, the use of manual labour.

New power driven equipment designed for British conditions, the Lennox-Lomax Auto Line Erection unit, is manufactured by Auto Mowers Ltd., and marketed by the LENNOX MOTOR CO. LTD. of Southsea.

Design is based on the Fordson Major tractor, the engine being used to provide motive power and to act as prime mover for the forward mounted earth drill and the rear mounted winch. The drive for the ancillaries is from the side power take-off sprocket by roller chain and they are both mounted on rigid box frames constructed from steel plate and sections. The gear box, through which the hexagon drill shaft passes, also carries the shaft guide channels with their struts and the two hydraulic rams which provide the power for vertical traverse of the drill. An interesting feature of the design is the use of flexible steel ropes which, connected through a pulley system, secure a doubling of the effective ram travel when transferred to the drill shaft. The whole drill assembly can be rotated by screw adjustment from the driving seat, thus enabling the shaft to be trimmed for vertical drilling on sloping ground.

The machine is very robust and has been extensively tested under arduous conditions with very satisfactory results. Drilling is fast and accurate. Up to the present time the limit has been 40 in diameter and 8 ft depth in various types of soil. The self-anchoring winch used alone can tension the heaviest conductors rapidly and safely. When used with the jib, loads of 30 cwt can be lifted up to a height of 12 ft and loads of 15 cwt up to a height of 16 ft. The machine can thus erect the heaviest poles and is useful for other jobs like installation of pole mounting transformers.

Mr. R. Woolley, Managing Director of Lennox Motors Limited, and Messrs. Grist and Medway of Auto Mowers Limited co-operated in the detailed design of the drill, and the development owes much to the efforts of Mr. Rickard of the former firm. The winch and jib are standard productions of Auto Mowers Limited.

The Schwebebahn's Half-Century of Public Service

Wuppertal's unusual suspension railway gives 50 years' trouble free operation

ABOUT the turn of the century the population of the three towns, Barmen, Elberfeld and Vohwinkel, later forming the city of Wuppertal, in the German Ruhr had reached such an alarming size due to the development of heavy industry there, that the transport facilities could not cope with the peak hour inflow and exodus of the work-people.

These cities are situated in the narrow valley of the Wupper River which at places is barely 100 yards across. Two railway lines and a train system were already in existence traversing the length of the valley. There was no room for extension here.

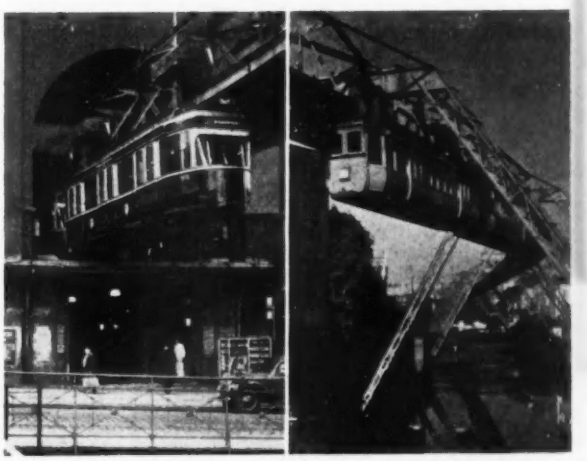
After considering many schemes the far-sighted municipal authorities decided to adopt the designs of the engineer Langen of Cologne. These were for a high-speed mono-rail suspension railway which would run through the valley over the river.

In 1898 work was started on an experimental section within Elberfeld. This was inaugurated in the next year. The section joining Vohwinkel was in service in May, 1901, and two years later Barmen was linked.

The "Schwebebahn", as it has now become generally known, has during its fifty years of existence conveyed over 680 million passengers with only one serious accident on record. The passengers are conveyed in cars with a capacity of 80, two of which are coupled to form a train.

At the present time the railways' service interval is three minutes, but when the new automatic signalling has been completed this will be reduced to two minutes. Doors on the new cars are pneumatically operated, the older types being closed by hand, but in all cases the mechanism ensures that the trains do not start until all doors are closed.

Each rail car is suspended on twin motor bogies, the system operating on 600 V d.c. supplies. The route mileage is 8·3 miles (13·3 km.) of which 6·2 lie directly over the Wupper.



About 2 miles of the Schwebebahn runs through the streets as seen in our photo at the top of the page. The route of the remaining 6 miles lies directly over the river as seen in the lower photograph. New cars have now been brought into service, one is seen leaving a station which incidentally is over the river

overseas news

British Plant for N.S.W.

An order, valued at £250,000, for diesel engined generating sets for the Electricity Commission of New South Wales, has been placed with the Brush A.B.O.E. group of companies. The order, placed by Mr. H. G. Conde, chairman of the Commission, while in Britain recently, is for ten Mirrlees HFS8 turbo-charged engines, each directly coupled to a 920 kW 6,000 V alternator, together with transformers and switchgear. Delivery is to commence in five months' time with completion in about twelve months, we understand. The Electricity Commission of New South Wales is in urgent need of additional generating plant, and orders have already been placed in America for packaged steam units, as we have reported. Mr. Conde has recently been to America, too, in an endeavour to expedite delivery of some of those sets.

Eildon Weir

Firing an explosive charge, the State Premier, Mr. McDonald, recently officially launched construction work on the £12,000,000 Eildon Weir extension project, Victoria. Among other things, this scheme provides for increasing the power production from 18,000 kW to 120,000 kW. Coinciding with the launching of the scheme, come reports that the contractors, the Utah Construction Co. have 'lured' employees from other concerns by the offer of 10% more money. Locally, the view is held that it is impossible to expand development projects without labour being brought from overseas.

Steel Shortage

Lack of steel for pipe lines, and transmission lines is having a serious effect on the Tasmania Hydro-Electric Commission's construction programme, the Commissioner, Mr. Knight, declared a few days ago. Orders for nearly 2,000 tons of steel had been placed in England, but delivery was still awaited. In the past few weeks the Commission had placed an order in Japan for about 2,000 tons of thinner plate, delivery of which was promised within three months. While the price of British steel, he said, was about 2½ times greater than the Australian price, the Japanese price was about five times greater.

South Fremantle

Assembly of No. 2 generator and No. 3 and No. 4 boiler units are nearing completion at the South Fremantle power station, Western Australia. When these are in operation the "A" station will be complete (No. 1 set has been running for about two months). The South Fremantle station is to have two sections—A and B—each with two 25 MW turbo-alternators.

Fraser Valley Project

Work will start soon on construction of the Boulder Creek dam which is part of the $10,000,000 hydro-electric project being undertaken at nearby Walleach Lake by the British Columbia Electric.

This phase will be carried out by the general contractor for the development, Northern Construction Co. and J. W. Stewart, Ltd. of Vancouver. The earth-filled dam, to have an impervious clay core, will have a height of 55 ft and a crest length of 1,350 ft. The shaft will measure about nine feet in diameter and 2½ miles long. More than 1,000,000 cu ft of rock and granite will be removed. By means of this tunnel penstock, waters of the lake will be dropped 2,000 ft to the Fraser above Rosedale to the 80,000 h.p. generating unit.

St. Lawrence Seaway

In Ottawa legislation is expected to be introduced in Parliament at the fall session clearing the way for Canada to go ahead on its own in the construction of a St. Lawrence power and navigation development. This however, does not rule out any possible joint Canadian-U.S. undertaking. It will be known shortly if Congress is going to approve U.S. participation this year. In the meantime, Ottawa has already taken preliminary steps to plan the legislation which will be laid before Parliament.

B.C. Purchase

Officials of the British Columbia Power Commission have intimated that the purchase by the commission of the Puntledge power plant from the Canadian Collieries (Dunsmuir) Ltd. and Wellington Collieries Ltd. will be delayed while the commission goes ahead with two other projects. The Provincial Government recently authorised the transaction estimated to cost $1,181,250, but allowed two years in which the purchase should be completed. For the Commission it has been explained that the purchase of the Puntledge plant would be part of an overall plan to increase Vancouver Island's power supply. By 1959 it is planned to increase supply from 112,000 h.p., now being developed at Campbell River, to some 200,000 h.p.

Advisors in Ontario

The appointment of a nine-member advisory council to the Hydro-electric Power Commission of Ontario has been announced. Among its members are Mr. D. P. Cliff, president of the Ontario Municipal Electric Association; Mr. M. W. Rogers, manager of the local Public Utilities Commission, and Mr. J. Clark Keith, general manager of Windsor Utilities Commission.

Kariba Gorge Recommended

The Inter-Territorial Hydro-Electric Power Commission—set up in 1946 to study possibilities of the Kariba and Kafue hydro-electric schemes in the Zambesi has recommended as an "unusually favourable" project the construction of a hydro-electric scheme at Kariba Gorge. This recommendation is made in the Commission's report, issued last week, which is now being considered by the Governments of Northern and Southern Rhodesia. It is suggested that the scheme should be carried out in two stages—the first, with plant to produce 385 MW, costing £43,500,000, and the second, with a capacity of 1,000 MW, bringing the overall cost up to £74,500,000. Construction would take eight years. The immediate potential load in Northern Rhodesia from the copper companies alone is about 100 MW. In Southern Rhodesia the demand of the Salisbury Midlands area is expected to be between 270 MW and 380 MW in 1962, depending on the rate of growth, while the Shabani, Gwanda, and Bulawayo areas, in the aggregate afford similar potential loads. It is estimated that hydro-electric power could be delivered at receiving stations at a cost of 0.2525d. per unit for the initial development, and at 0·1703d. per unit for the final development.

Particulars of the Kariba Gorge and Kafue schemes were given in an article by Mr. H. L. Whitehouse, M.A., A.M.I.E.E., M.I.R.E. on page 703 of our June 10, 1948, issue.

Kosi Dam Project

An Advisory Committee to scrutinise the first stage of the Kosi Dam project, has been appointed by the Government of India. Chairman of the committee is S. C. Majumbar, consulting engineer to the West Bengal government, and other members include G. Sundaram, chief engineer (electrical) to the Madras Government, and B. S. Mag, project officer, Central Water and Power Commission. In view of the magnitude and complexity of the project, it has been decided to divide it into seven stages, each self supporting and independent. The project report of the first stage is now ready for execution. It is estimated to cost Rs. 10.5 crores and involves the construction of a railway line from Jogbani to Barakshetra (near the site of the dam); the barrage; a power channel up to power house No. 1; two power units of 10,000 kW each; and the first instalment of essential transmission lines in Nepal and Bihar. This first stage is an essential preliminary to the construction of the main dam as well as for the extension of irrigation from the normal supplies of the river and the generation of power in the pre-dam stage. The Kosi, the third largest Himalayan river, which flows through Nepal and Bihar, has been causing havoc in the area through which it flows not only by flooding and deposit of sands, which are its annual features, but also by the frequent changes in its course thus laying waste the areas through which it flows.

New Kashmir Station

The new Pahlgham electric power station, Kashmir, about 64 miles from Srinagar, was formally opened a few days ago by the Government of India's Minister for States, Mr. Gopalaswami Ayyangar. He said he was glad the State Government was alive to the great potentialities available in the Himalayas and was also tapping other sources like the Sind Valley Project to provide electricity to the State. The 7,000-feet-high tourist station of Pahlgham was one of the most beautiful spots in Kashmir, and electrification here would mean greater amenities for tourists.

Imports Needed

Removal of import restrictions on electric cookers and other domestic electrical appliances from Britain and Canada is to be sought by the Hawke's Bay Electric Power Board, New Zealand. This was decided after the chairman, Mr. M. S. Chambers, who was recently overseas, said that New Zealand lagged far behind in the supply of modern-design domestic electrical appliances. He contended that at the least warming ovens should be compulsory with the electric cookers made in New Zealand, for they were a necessity and a great power-saver. It was high time that an up-to-date type was put into production, he declared.

N. Z. Power Consumption

The impact of cold weather has caused a sharp increase in power consumption in both North and South Islands, N.Z. Record weekly figures have already been reported in the South Island, where hopes are centred on the earlier operation of the new Tekapo hydro-electric scheme. At that station a fault occurred in the initial running of the 25,000 kW generator. An official has declared that if water continues to be drawn from storage at the present rate to generate power, the State Hydro-Electric Department will have exhausted it, and be depending on river flow, by August 12. After that, relief will come only with the spring rains, which, it is hoped, will fall in September. In regard to the North Island, Mr. Goosman, Minister of Works, has optimistically prophesied that power restrictions will end next year with the operation of the Maraetai project, which will add 40% to the Island's generating capacity.

Israel Investigates

Following agitation arising out of recent power cuts, the Israeli government has decided to appoint a committee to investigate the electricity supply position. The move has, in fact, been welcomed by the Palestine Electric Corporation Ltd., who have drawn attention to the lengthy delay involved in planning and putting into operation new generating plant. The company has pointed out that the 30MW set commissioned at the end of 1949 was ordered in 1945, while a second similar set, ordered in 1947, was now on its way to Haifa.

PERSONALITIES

IN THE INDUSTRY

At present district manager of the Huntingdon district, Fens sub-area of the Eastern Electricity Board, **Mr. G. B. Pierpoint,** A.M.I.E.E., A.M.I.I.A., has been appointed district manager of the Wembley district of the Board's Northmet sub-area, in succession to Mr. T. Hollins, whose retirement we have already noted. Mr. Pierpoint was educated at the Bradbury School, Hale, Cheshire and Plant's College, Manchester, and received technical training at Manchester College of Technology. He joined Manchester Corporation Electricity Department as a junior engineer in 1926. In 1929 he became a development engineer with the Scarborough undertaking and in 1936 went to South Shields as consumers' engineer. There, he was appointed deputy borough electrical engineer in 1939, retaining that post until 1948. On February 1, 1949, he was nominated to his present position. Mr. Pierpoint takes up his new job at Wembley as from August 1.

Mr. G. B. Pierpoint

Colonel A. G. Woods, D.S.O., M.C., M.I.Mech.E., A.C.C.S., who has been the secretary of the No. 7 Sub-Area of The North Western Electricity Board since shortly after vesting day, reaches retiring age on July 25 next. Prior to vesting he was well known in the Electricity Supply Industry in the north-west as the wayleaves officer for the Central Electricity Board. He also served with distinction in two World Wars and took part in the first tank attack which was mounted on the Somme in September, 1916. In this action he won the M.C. In his capacity as Sub-Area secretary he has also served with distinction, and he goes into retirement with the best wishes of the Board and of his many friends.

A number of new appointments are announced by the Brush Aboe Group : **Mr. John Ayres,** M.I.E.E., M.I.P.E., F.I.W.M., who for the past five years has been works director (Loughborough) of the Brush Electrical Engineering Co. Ltd., has been appointed general manager (local) of Petters Limited at Staines. **Mr. C. F. Barnard** has just been appointed assistant general manager of the National Gas and Oil Engine Co. Ltd., Ashton-under-Lyne. He was seconded to National Gas last September, and prior to this was assistant general manager of Mirrlees, Bickerton and Day. **Mr. E. J. Batchelor,** managing director for the past four years of Brush Coachwork Ltd., has now been appointed Vice-chairman of that company. **Mr. K. N. Eckhard,** M.I.E.E., M.Inst.T., M.I.Loco.E., former chief electrical engineer of the Central Argentine Railway (now the F.C.N., G., Bme Mitre), has been appointed to the Board of Brush Bagnall Traction Ltd., as director and general manager. Mr. Eckhard has spent 39 years in Argentina and was responsible for the Buenos Aires suburban electrification of the Central Argentine Railway and also the diesel traction operation of that Railway. He was a member of the Motive Power Commission which visited the U.S.A., U.K., France and Switzerland in 1945 to study the latest forms of railway motive power, particularly diesel electric traction. **Mr. B. D. Giordan,** B.Sc., A.M.I.Mech.E., who joined the group in 1948, is the new general manager of Mirrlees, Bickerton and Day.

Mr. F. H. Maiden, A.M.I.E.E., has resigned from the staff of the Brush Electrical Engineering Co., Ltd., and taken an appointment as senior assistant engineer with the British Electricity Authority in the Salford district.

Johnson, Matthey and Co., Ltd., have appointed **Mr. P. D. F. Varrall** as secretary, thus freeing **Mr. L. C. Montague** who has been secretary since 1934 and a joint managing director since 1946, to devote more time to his duties in the latter capacity.

Nearly 300 guests attended the Overseas Reunion Dinner of the General Electric Co., Ltd., held at Claridges recently, when Sir Robert Menzies, chairman of the British India Corporation and guest of honour, replied to the toast of "The Guests" proposed by Sir Harry Railing. Our photograph, which was taken on that occasion, shows (*left to right*): **Mr. Leslie Gamage,** the **Rt. Hon. J. B. Chandler,** Lord Mayor of Brisbane, and **Sir Harry Railing.**

At the G.E.C. Overseas Reunion Dinner

Mr. A. Comar Wilson, has been elected a director of Associated Electrical Industries Ltd.

News has been received of the resignation of **Mr. J. E. M. Johns,** from the position of general manager of the Valve Division of Mullard Ltd., after twenty-four years service with the Company. His address is now "Tree Tops", The Ridgeway, Radlett, Herts. Tel. Radlett 6785.

Mr. J. E. M. Johns

The Minister of Fuel and Power has appointed **Alderman J. Village,** of Liverpool, and **Mr. J. A. Johnson,** of Holywell, Flint, to the Merseyside and North Wales Electricity Consultative Council. They replace **Alderman W. G. Gregson,** J.P., of Kirkby, and **Mr. Geoffrey Summers,** of Shotton, who have resigned from the Council for business reasons.

From Canada comes the news that **Mr. Derrick ("Bill") Murdoch,** has been appointed sales manager of the Jewel Radio Co. of Canada, in Toronto: Mr. Murdoch has been associated with the radio industry since 1927, and before going to Canada, was with the G.E.C. Ltd., and later sales manager of Truvox Ltd.

We understand that **Mr. T. H. Carr,** M.I.E.E., M.Inst.C.E., M.I.Mech.E., F.I.F., formerly manager of No. 1 sub-area of the Y.E.B., has been appointed as manager of the combined No. 1 and 2 sub-areas (Bradford and Huddersfield). Our information is also that **Mr. W. Moody,** A.M.I.E.E., formerly manager of No. 5 sub-area, has now been appointed manager of the combined Nos. 4 and 5 sub-areas (Leeds and Wakefield).

By some inexplicable mischance a wrong illustration was unfortunately used in our note last week concerning **Mr. F. H. Batt,** A.R.C.Sc.I., M.I.E.E., who is retaining his seat on the board of British Electric Meters, Ltd., and has been appointed technical and sales director. Readers may have spotted that the photograph used was that of Mr. W. K. Brasher, C.B.E., secretary of the Institution of Electrical Engineers. The correct photograph of Mr. F. H. Batt we reproduce alongside, and, while deeply regretting the error, we offer our sincere apologies to both the gentlemne concerned for any embarrassment caused.

Mr. F. H. Batt

We were somewhat premature in our announcement last week that **Mr. H. Pryce-Jones,** M.Eng., M.Inst.C.E., M.I.E.E., M.Inst.F., had been inducted as president of the Association of Public Lighting Engineers—that ceremony is to take place immediately prior to the official opening of the Association's conference on September 18. Meanwhile, Mr. Pryce-Jones is, of course, the president-elect. We offer our apologies for any inconvenience caused.

Mr. H. Pryce-Jones

Mr. W. B. Baxter, a director of the United Steel Companies, has retired from the board and from his position as technical consultant to the Appleby-Frodingham Steel Works at Scunthorpe, on reaching the retiring age. He went to North Lincolnshire in 1914 as chief electrical engineer to the Frodingham works and was largely responsible for the addition of the Appleby works, built between 1918 and 1927. In 1948 he was awarded the C.B.E. for his services to the steel industry. From 1929 to 1940 he was general manager and a director of the works.

Mr. T. Nolan, A.C.I.S., accountant to No. 4 (Leeds) Sub-Area, Y.E.B., has been elected to the office of junior vice-president of N.A.L.G.O. He has been a member of N.A.L.G.O.'s National Executive Council, has served on all of its main committees and is one of the Association's Trustees. He is a member of the Yorkshire District Committee, of which he was Hon. Treasurer from 1932-1948, and is Chairman of the District Consultative Committee for the Electricity Supply Industry.

He was appointed to the National Joint Council (Administrative and Clerical Grades) when it was set up in 1948, but subsequently resigned owing to the proposed formation of the National Joint Managerial and Higher Executive Grades Committee, upon which he will serve as one of N.A.L.G.O.'s representatives.

The International Nickel Company of Canada Ltd., announce the election to the Board of **The Honourable Lewis W. Douglas,** former American Ambassador to the Court of St. James, and **Mr. I. C. Raymond Atkin,** who is Vice-President, Director and Member of the Executive Committee of J. P. Morgan and Co., Inc.

We hear that **Commander C. F. Nock,** D.S.O., R.N.(Retd.), late sales director of Tuscan Engineering Co. and Tuscan Industries, Ltd., and formerly sales manager of the Hopkinson Electric Co., Ltd., has resumed naval service and has been appointed to the staff of the Admiral Commanding Reserves.

Brookhirst Switchgear Ltd., announce the appointment of **Mr. William Jones** as manager

of the Bristol Office in succession to the late Mr. H. J. Barber. Mr. Jones has had nearly thirty years' experience with the company including seventeen years in the London area, first in the capacity of service engineer and latterly as sales representative.

Lewis's Ltd., announce that their buying controller **Mr. E. Johnstone** has been appointed general manager of the Glasgow store. **Mr. W. G. Doughty**, formerly electrical buyer, has been appointed general manager in their Manchester establishment.

I.E.E. AWARDS

The Council of the Institution of Electrical Engineers has made the following award of premiums for papers read or accepted for publication during the session 1950-51:

Group A

The *Kelvin Premium* has been awarded to **B. Adkins,** M.A., B.SC.(ENG.).

The *John Hopkinson Premium* has been awarded to **R. J. Clayton,** M.A.; **D. C. Espley,** O.B.E., D.ENG.; **G. W. S. Griffith** and **J. M. C. Pinkham,** M.A.

Group B

Llewellyn B. Atkinson Premium has been awarded to **J. H. Mason,** B.SC.

Extra Premium has been awarded to **H. F. Church,** B.SC.

Measurements Section.—*Silvanus Thompson Premium* has been awarded to **A. H. M. Arnold,** PH.D., D.ENG. *Mather Premium*: **J. G. Yates,** M.A.; **D. H. Lucas,** B.A.; and **D. L. Johnston,** B.SC.(ENG.). *Extra Premiums*: **E. H. Cooke-Yarborough,** M.A.; **E. W. Pulsford,** B.SC.; **H. H. Rosenbrock,** B.SC.(ENG.); **J. R. Tagg,** B.SC.(ENG.); **D. Taylor,** M.SC., PH.D.; **J. Sharpe,** B.SC.; **W. Abson,** B.SC.; **Humphry M. Smith,** B.SC.; **J. R. Boundy,** B.SC.; **S. A. Bergen,** M.B.E.; and **O. I. Butler,** M.SC.

Radio Section.—The *Duddell Premium* has been awarded to **P. A. T. Bevan,** B.SC., and **H. Page,** M.SC. *Ambrose Fleming Premium*: **J. A. Saxton,** PH.D., B.SC.; **G. W. Luscombe,** B.SC.; and **G. H. Bazzard,** B.SC. *Extra Premiums*: **E. A. Nind,** B.SC.(ENG.); **E. McP. Leyton**; **Caradoc Williams,** B.SC.(ENG.); **L. Essen,** D.SC., PH.D.; **W. S. Melville,** B.SC.(ENG.); **R. W. Douglas,** B.SC.; **E. G. James,** PH.D., B.SC.; **H. B. Rantzen,** B.SC.(ENG.); **F. A. Peachey**; **C. Gunn-Russell,** M.A.; **D. G. Kiely,** M.SC.; **Instr. Lieut. A. E. Collins,** B.SC., R.N.; **G. S. Evans**; **A. W. Lines,** B.SC., PH.D.; **G. R. Nicoll,** B.SC. (ENG.); and **Mrs. A. M. Woodward,** M.A.

Supply Section—*Sebastian de Ferranti Premium* has been awarded to **H. Leyburn,** B.SC.(ENG.), and **C. H. W. Lackey,** B.SC. *John Snell Premium*: **T. F. Monahan,** B.SC. *Extra Premiums*: **A. C. H. Frost,** B.SC.(ENG.), and **W. Brittlebank,** B.SC.

Utilisation Section—*Crompton Premium* has been awarded to **M. J. J. Cronin**, *Swan Premium*: **W. D. Chesterman,** B.SC.; **D. R. Clegg**; **G. T. Peck**; and **A. J. Meadowcroft.** *Extra Premium*: **T. H. Petch,** M.A.

Group C

Heaviside Premium has been awarded to **G. G. Macfarlane,** B.SC., **Dr. Ing** and **Mrs. A. M. Woodward.** *Paris Exhibition* (1881) *Premium*: **D. B. Hogg,** M.B.E. *Overseas Premium for Students and Graduates*: **G. W. Donaldson,** B.E. *Students' Premiums*: **C. R. Bates**; **R. W. Gee**; **K. F. Tee**; **J. C. Shaw,** B.SC.; **P. D. Aylett**; **B. Berger,** B.SC.(ENG.); **D. Bolton,** B.SC.(ENG.); **E. J. R. Hardy,** B.SC.(ENG.); **I. J. Shelley**; **D. S. Williams,** B.A.

OBITUARY

The death is announced of **Mr. H. C. Mills,** Managing Director of the Morgan Crucible Co., Ltd. on June 27.

Mr. W. H. Wigston, director of the Electrical Division of the Britannia Engineering Co., died on June 26. Prior to joining that firm he had served for more than 20 years with the British Thomson-Houston Co., Ltd., latterly as assistant manager of the Lighting Department. He was also chairman of the Electric Discharge Lamp Auxiliaries Council for a number of years.

Sir Theodore E. Thomas, C.B.E., who was general manager of the London Passenger Transport Board from 1943 to 1945, died on July 3, aged 69. He had been associated with London transport for the whole of his career, gaining early technical experience with London United Tramways Ltd., from 1899 to 1902. In 1909 he became district engineer and after other promotions was appointed traffic manager of L.C.C. Tramways in 1925, and general manager in 1933. He served as general manager, operation, with the L.P.T.B. from 1936 to 1943 when he became general manager.

The death has occurred at the age of 72 of **Mr. Leonard J. Couves,** senior partner in the firm of L. J. Couves and Partners, architects, Newcastle-on-Tyne, who have for some years carried out architectural work in connection with new power stations in the northeast.

The death is reported of **Mr. William Sutcliffe,** M.I.E.E., A.M.INST.C.E., late of the English Electric Co., Ltd. Mr. Sutcliffe was residing in Glasgow at the time of his death, which occurred after a short illness.

WILLS.—Mr. Fred Leslie Brown, of Rannerdale, Ladybridge Lane, Heaton, Bolton, electrical engineer, who died on November 30 last, aged 57 years, left £11,238 10s. 11d. gross, £9,836 2s. 4d. net value.

Lady Caroline Maude Gill, widow of Sir Frank Gill, K.C.M.G., O.B.E., who died on May 23 last, left £80,723 16s. 3d. gross, £80,652 18s. 9d. net value.

Mr. Alan Wright, of Johannesburg, South Africa, a former director of Best Products, Ltd., Felixstowe, who died on March 8 last, domiciled in South Africa, left estate in England valued at £2,529 16s. 4d. gross, £2,526 13s. 4d. net.

The BUYER'S *Column*

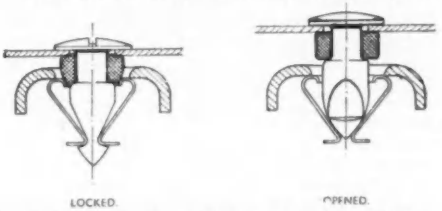
Economy in Maintenance

PLANT engineers facing increasing costs in their routines of preventive maintenance are likely to find considerable help from materials recently introduced into the electrical field by WALTER SHAW, LTD., 95 Great Portland Street, London W.1. Outstanding is a permeable rubber-base synthetic which makes an admirable substitute for chamois leather at a fraction of the cost, and has many other possibilities in the industry. Modifications of the manufacturing process permit production of light cotton waste and rubber bags, with a strength stated as 150 lb/sq in. bursting pressure. These should have applications to the storage of material and spares.

Click-fastening

A FASTENER which helped to win the war when it was fitted in Britain's wartime Spitfires, Sunderlands, Wellington and Lancaster bombers and is now being used to win the peace through production, is the "Oddie" fastener by ODDIE, BRADBURY AND CULL LTD., Portswood Road, Southampton.

This spring-loaded clip is fitted by pushing into



This drawing shows the principle of the Oddie Fastener

position when it clicks into place, firmly gripping the panel or covering which it is to anchor. It is easily removed by turning the fastener stud by screwdriver, when it forces apart the retaining spring clips and is easily removed.

Its peace-time uses are numerous. Oddie fasteners are to be found in shipbuilding, engineering, radio and television, motor cars, refrigeration and domestic and office equipment, in fact wherever a problem of quick release fastening is encountered.

Fluorescent Lamps on 110 V Supplies

TO enable the advantages of fluorescent lighting to be obtained in areas where the a.c. supply voltage is in the 110-130 V range, a new step-up transformer is now available from CROMPTON PARKINSON, LTD., Crompton House, Aldwych, W.C.2.

The transformer has a continuous rating of 200 W which allows a maximum load of two 80 W tubes, provided p.f. correction is made as in the normal 80 W circuit. It will work all standard wattages of fluorescent tubes with their appropriate control gear. The step-up ratio is approximately 2-1, but the exact ratio varies according to the load.

Brighter Buses

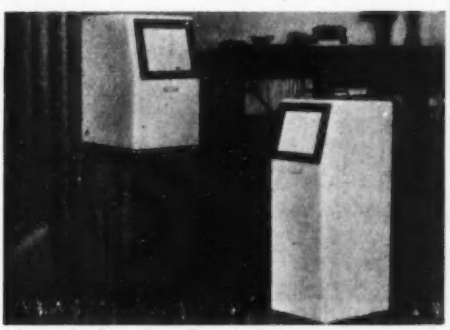
A NEW range of heavy duty traction lamps has been introduced by OMEGA LAMPWORKS LTD., Rodney Place, Merton Abbey, S.W.19.

In wattages 100, 150 and 200, these types are in addition to the normal 40- and 60-watt rough service lamps. Built to withstand an inordinate amount of vibration, they give a high light output comparable to that of an ordinary general service lamp.

In addition to these types the firm produce a range of helical anti-vibration lamps from 300 watts upwards. These are suitable for normal lighting positions where some degree of rough usage is encountered.

Daylight Film Strips

EDUCATION and advertising are two related fields of activity which are likely to benefit from the introduction by NEWTON AND CO., LTD., 72 Wigmore Street, W.1, of the "Rotovisor." This is a film strip device which can project on to its self-contained screen a picture the detail of which is readily perceivable even against bright sunlight. The essence of the device is the use of a 250 W mercury vapour lamp as a light source. Incorporated in the "Rotovisor" is a mechanism automatically changing the picture shown every 12 seconds, with provision for holding any desired frame for a longer period. Both table and console models of the "Rotovisor" are available, and there is a modification which can deal with colour films, though at a lower intensity of illumination.



Newton's Rotovisor for daylight viewing uses a h.p.m.v. lamp as light source

Temperature Control

THREE distinct types of temperature control equipment for industrial uses are now available from ELCONTROL LTD., 10 Wyndham Place, London W.1.

All three are electronic; they employ different temperature sensing devices and all are "on/off" controllers.

First is the photo-electric controlling pyrometer for use where an incandescent mass (or flame) is viewed by photo-electric cell. Range of control is from 800 to 2,000 deg. C. Equipment is for 200/250 V, 50 c/s a.c. supply. Price varies between £60 and £100. Second is the thermocouple indicating controller, in which a thermocouple actuates a millivoltmeter in the control unit, the movement of the pointer being used to operate the relay. This equipment, for a.c. operation, costs £30 for the control unit; the price of the thermocouple varies according to the type used.

A third type, the resistance thermometer controller, relies on the out-of-balance current in a resistance bridge circuit operating a relay. This pattern complete is priced £25 (approx.).

Adjustable Girder Clips for Cables

BEING currently advertised is a new design of cable clip adjustable to fit all shapes and sizes of girders and beams.

Makers of these useful accessories, EVANS AND NEWALL LTD. (T.I.M.), in association with E. M. EVANS AND SON LTD., Cornwall Street, New Cross, Manchester 4, point out that the clips can be fixed with ease to steel joists, tees and angles and to concrete or wood beams.

Approved for use by the Ministry of Supply as a valuable time- and labour-saving item, these clips are considered the most rigid fixing type available.

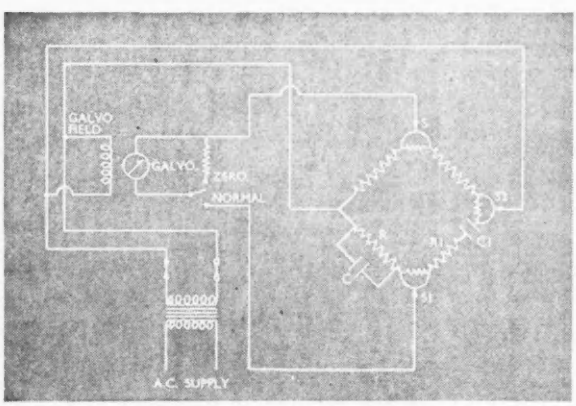
The plates, wires and fittings are adjustable and interchangeable so that the electrician can fix conduit cables, heating and water installation pipes either parallel or at right angles to girders as desired.

Standard clips are suitable for girders up to 5 in. and accommodate $\frac{5}{8}$ in., $\frac{3}{4}$ in. or 1 in. saddles, whilst large and extra large sizes are available for girders up to 10 in. and to accommodate up to five runs of 1 in. tube and twin 2 in. saddles.

A New Frequency Recorder

THE accurate recording of the frequency of electrical power supplies is of importance in a number of industries, notably of course in the electricity supply industry itself. There has for some time been a need for a recorder of extremely high accuracy covering the small range of frequency usual for power supplies from the grid or from industrial power plant. This demand is now met by George Kent Ltd., London and Luton, who have developed a reliable instrument from a prototype originally designed for use in the firm's own research and development department. Where an industrial process is dependent on the reception of current at a steady frequency, within certain limits, a continuous record of variations in the supply frequency is essential for accurate process control.

The circuit of the instrument is as shown. Fundamentally it is a Wien bridge. The resistances and condensers, R, R1, C, C1, have the values necessary to provide the required range of the instrument, usually 47 to 51 cycles per second. S, S1 are mechanically coupled slidewire contacts working in tandem which balance the circuit until no current is passing through the galvanometer, according to the well-known null-point method of measurement. The scale of the instrument is approximately linear. Accuracy is of a high order: + 0·03 cycles per second over the whole range; while the recorder is sensitive to changes in frequency of less than 0·01 cycles per second. While the range 47 to 51 cycles per second is normal with this new instrument, the circuit values can be adjusted to cover other small ranges of frequency of the same order.



Schematic circuit of frequency meter

By modifying the scale to read revolutions per minute, the instrument may be adapted to record the speed of operation of a generator, where speed variations cover a short range only. Standard scales at present available read 47 to 51, 51 to 47 or 48 to 52 cycles per second.

Watthour Meter Design

Single disc 3-phase types

COMPLYING with B.S.S. 37:1937 and approved by the Ministry of Fuel and Power, the types ZF33 (two-element, three-wire) and ZF34 (three-element, four-wire) polyphase watthour meters have been introduced by Measurement Ltd.

These are of the single-disc induction pattern, in which each driving element, consisting of a current and voltage electromagnet, exerts a driving torque on a single disc motor.

The driving elements are magnetically separated from each other to minimise magnetic interference between elements, whilst eddy current interaction is neutralised by a new design of rotor disc. Driving torque is imparted to an outer conducting annulus, while an inner disc, insulated from the outer ring, counteracts the remaining amount of interaction by co-acting with the rotating field produced by the fluxes from the driving elements. Magnetic interaction is further minimised by the use of a non-magnetic frame for carrying the two high-energy brake magnets which are turned on their axes to provide variation in braking.

The current and potential electromagnets are of similar design to those employed in the company's single-phase meters, being corrected for errors due to variations in voltage, temperature and current overload.

Construction

Both types of meter are built on a common frame consisting of an upper and a lower silicon-aluminium casting and mild steel side plates bolted together. These side plates to which the driving elements are attached, carry the register gear fixing pillars, magnet fixing bushes and bushes for the light-load adjustment screwed rods. Each driving element complete with shunt and series electro-magnet, and their respective adjustments for full-load torque, quadrature and full-load adjustment, is built into the mild steel plates of the frame.

The torque-balance adjustment consists of an adjustable counter-pole opposite the main shunt pole, and magnetically in contact with the outer poles and the frame. The variable air gap draws off a proportion of the shunt flux through the frame. A variable resistance type of adjustment is provided for inductive load, and voltage compensation is by means of a saturable magnetic bridge across the gaps. Overload compensation, light load adjustment and temperature compensation are included.

The braking system consists of a pair of U-shaped Ticonal magnets pivoted on their axes in a gunmetal casting, the flux return path being provided by mild steel counterpoles attached to the underside of the upper arms of the casting. Variations in braking are effected by turning the magnets on their pivots, and the magnets themselves are encased in a jacket of plastic moulding material to safeguard them from the demagnetising effects of steel tools.

E.R.A. Reports

READERS may care to note that the following reports of the Electrical Research Association were recently released for publication. They may be obtained from the Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey, at the price noted, this being inclusive of postage.

G/T234, "Gas-Blast Circuit-Breakers: Aerodynamic Conditions in Nozzle as Affected by Arcing and Nozzle Diameter," by A. M. Cassie and A. A. Hudson, 12s. 4d.; G/T239, "Restriking Voltage in British 66 kV Networks," by L. Gosland and J. S. Vosper, 7s. 9d.; G/T250, "The Maximum Energy Dissipated During First Current Loops of Different Asymmetry on Closing an A.C. Series Circuit," by H. Goldenberg, 6s. 3d.

IB/T5, "Some Notes on the Design, Testing and Performance of an All-Electric In-Sack Grain Dryer," 2s. 9d.; L/T256, "The Development of a Vacuum Torsion Balance and its Use to Measure Sorption in Dielectrics," by A. G. Day, 12s. 4d.; W/T21, "Electrode Soil Sterilising (Preliminary Report)," by A. E. Canham, 9s. 3d.

NEW LITERATURE

Kempe's Engineer's Year Book, 1950-51

edited by B. W. Pendred, M.I.Mech.E.

FOR once, Kempe spans two years: such a departure from regularity in this firmly established reference book is accounted for by the fairly drastic revision that has occurred. Most noticeable of the changes is the abandonment of section and part numbers, and some consequent rearrangement of material. In general, though, Kempe's remains as useful and as recognisable as ever, in its handy two-volume form. Published by Morgan Bros. (Publishers) Ltd., 28 Essex Street, Strand, W.C.2; two volumes, 2,915 pages, 7 in. by 4½ in. Fifty-sixth edition, price 65s.

The Electricity Statutes

compiled by Norman Elliott,
O.B.E., M.A., M.Inst.C.E., M.I.E.E.

AFTER the passing of the 1947 Act a number of publications appeared dealing with the new legislation relating to electricity supply. Since then important changes and additions have been made and it is, therefore, useful to have this work which can be regarded as a second edition of the original book published by the London and Home Counties J.E.A. As far as the earlier Acts are concerned only the clauses still in force are printed, although the subject matter of the repealed clauses is mentioned. These are followed by the complete 1947 Act, together with sections of other relevant Acts, including the Public Utilities Street Works Act, 1950. The end of the book contains a complete set of statutory instruments relating to electricity supply (including some which are no longer in force) and thus provides the convenience of having them all bound in one volume. Since law develops by something like geometric progression, it is essential to have current reference books and the present work offers this at an exceptionally moderate price. Obtainable from the Secretary of the South Eastern Electricity Board, 630 pages. Price 1 guinea.

Transformers — Principles and Design for Light Electrical Engineers

by F. C. Connelly,
Ph.D., A.M.I.E.E., D.I.C., A.R.C.S.

IN the general engineering field, considerably more attention is usually paid to the design of medium and large power transformers than to the smaller units utilised in research, radio, and telecommunications fields; and, as many engineers have discovered by sad experience, it is not practicable to scale-down for what the average transformer designer thinks of as "mouse-power" ratings. Those to whom small transformers are of importance will have good reason to be grateful to Dr. Connelly not only for giving them the information but for the form in which it is given. The conventional method of teaching design is a step-by-step process, each aspect being thoroughly covered before proceeding to the next—a process analogous to examining the technique of an oil painting in sections through a magnifying glass before one has taken in the whole picture. The author's method consists in allowing rapid glimpses of the complete picture, with a subsequent return to examine essential points in more detail—a far more satisfying method for the reader who is not aspiring to become primarily a transformer designer, but needs to acquire the technique as an ancillary accomplishment. The professional designer however will find much valuable information therein, since the range covered—from small power transformers to h.v.; auto; variable ratio; vibrator; current and voltage; radio and television transformers is exceedingly wide. Published by Sir Isaac Pitman and Sons, Ltd., 490 pages, 8½ in. by 5½ in., with 179 illustrations. Price 35s.

BOOKS RECEIVED

The Nationalised Industries, by D. N. Chester A comparative analysis of the statutory provisions. Published by Allen and Unwin Ltd., 93 pages, 8½ in. by 5½ in. Second edition, price 7s. 6d.

AC/DC Test Meters, by W. H. Cazaly and T. Roddam. Practical handbook of multi-range workshop grade instruments for testing low-power apparatus. Published by Pitman, 180 pages, 7½ in. by 4½ in. Price 18s.

Echo Sounding at Sea, by H. Galway. Deals with technique of echo sounding at sea, and with the equipment, and studies in detail the main Hughes and Marconi type of echo sounding equipment. Published by Pitman, 299 pages, 8½ in. by 5½ in. Price 35s.

Railway Standard Charges. Covers station to station rates and cartage rates. Published by Railway and Shipping Publishing Co. Ltd., 12 Cherry Street, Birmingham 2, 31 pages, 11 in. by 8 in.

Alternating Current Circuits, by R. M. Kerchner and G. F. Corcoran. Covers alternating current circuit theory at undergraduate stage. Published by Chapman and Hall, 598 pages, 9 in. by 5¾ in. Third edition, price 44s.

Radio Installations, by W. E. Parnett. Principles of design, construction and maintenance of modern radio transmitting and receiving installations, from the point of view of the practising engineer. Published by Chapman and Hall, 454 pages, 8¾ in. by 5½ in. Price 45s.

Dielectric Breakdown of Solids, by S. Whitehead. Summarises results of recent academic and long-term research into the subject. Published by Geoffrey Cumberlege at the Oxford University Press, 271 pages, 8½ in. by 5½ in. Price 25s.

THE WEEK

COMMERCE *in news* INDUSTRY

U.K. Tariff Concessions

SOME alterations in U.K. Tariff are to come into force on September 1, as a result of concessions agreed upon by this country during the recent conference at Torquay. The items on which rates of duty are to be altered were given in the Board of Trade Journal last Saturday but a full list of these concessions is contained in the U.K. Tariff Schedule No. XIX, annexed to the Torquay Protocol to the General Agreement on Tariffs and Trade. Few electrical goods are covered by the new agreement. Duty on electric motor and generator casings and unwound rotors and stators has been changed from 15% to 10%. For carbon brushes with metal terminals or connectors, and for perforated separators the change is from 20% to 15%. The new rate on arc-lamp carbons, other than those covered with copper and not exceeding 14 mm in diameter, is 2s. 6d. per lb. Other decreases are in respect of porcelain insulators over 2 lb in weight, from 20% to 15%; permanent magnets from 33⅓% to 20% and ignition magnetos from 33⅓% to 25%.

Employment in Electrical Industry

ESTIMATED numbers of employees in Britain at the end of May, 1950, have been published in the Ministry of Labour Gazette for last month. Figures have been analysed under headings of male and female, industry and age groups and we have noted relevant estimates. In the electricity supply industry for instance, we note that 161,000 men and 21,000 women were employed at that time. Under the heading of electrical wiring and contracting the numbers of employees totalled 60,000. Those engaged in the manufacture of electrical goods have been sub-divided under machinery, wires and cables and "other electrical goods" in which male employees numbered 126,000, 39,000 and 70,000 respectively. Similar figures for women were given as 44,000, 22,000 and 49,000. These estimates have been based on the counts of insurance cards exchanged and are prepared annually.

Encourage use of Private Plant

THE North Midland Regional Board for Industry has passed a resolution suggesting that the installation of private generating plant by industrialists should be encouraged by every possible means in view of the present steady increase in demand for electricity which continues to outstrip the capacity of new and existing plant installed by the B.E.A. It is added that a strong appeal to owners of private generators should be made by the Government, B.E.A. and Area Boards to ensure that this privately owned plant makes the maximum contribution to the national need. The resolution has been forwarded to the electricity sub-committee of the National Joint Advisory Council. It was also proposed that as a contribution to the long-term solution domestic consumers should be asked to make greater use of gas for cooking and heating as this fuel could be stored for consumption during peak hours.

Oil Lamps for New Houses?

PROBLEMS of connecting new houses, and the overall consumption of electricity are viewed with concern throughout the supply industry, more especially following Lord Citrine's comment at the B.E.P.C. that arbitrary action may have to be enforced by law to secure a substantial reduction in domestic and commercial consumption. At a meeting of the S.E. Scotland Electricity Consultative Council last week, one member suggested that new housing schemes should not be fitted for electricity but should burn oil lamps and coal fires, as one method of overcoming part of the difficulty. A person getting a new house, said the speaker, would be able to bear the temporary loss better than the man who had been waiting for electricity for years. It was decided to discuss the matter further at the next meeting.

A New Problem

SUNDRY reports have reached us during the past few weeks of Boards' inability to connect new houses to mains, but news has come this week of a reluctance to wire houses although the appropriate Board has agreed to supply electricity. The matter arose at last week's meeting of the Merseyside and N. Wales Consultative Council when Southport Corporation gained the Council's support to an application for sanction to a loan to install electricity in 186 houses on the Essex Road estate, built some twenty-five years ago. The

The First Half-Century

Yesterday saw the formal inauguration of the electrical tramway system provided in the western suburbs by the London United Tramways, Limited. On Whit Monday the passengers numbered no less than 210,657 and the pleasure traffic on Saturdays and Sundays is so great that at the Shepherds Bush terminus, the whole roadway—wide as it is—is blocked with a solid mass of people struggling to get on.—*From our issue of 11 July*, 1901.

Mr. G. W. Richards, deputy sub-area manager and Mr. S. F. Steward chairman, S.W.E.B., with Mr. G. Robinson of English Electric, inspecting that company's model of a 66 kV air-blast switch

Ministry took the view that the scheme should be postponed for 18 months. The Council decided to forward a resolution to the Ministry of Fuel and Power drawing attention to the problem and supporting Southport's plea.

A Scottish Conference

SCOTTISH branches of the Incorporated Plant Engineers are arranging a conference to be held at Dunblane Hotel Hydro, Perthshire, between October 5 and 7. On the Saturday morning two talks will be given, by Mr. D. Lacy-Hulbert, president of the Institution, and Mr. J. F. Field, controller of the S.E. Scotland Division of B.E.A. The following morning Mr. L. G. Northcroft is to speak on "Coal and Europe." In addition to the more serious matters, an attractive programme of social activities, including dances, golf and coach tours, is being arranged.

In the Service of the Community

SET in the modern showrooms opened last November in Colston Avenue, Bristol, the S.W. Electricity Board's Festival Exhibition entitled "Electricity in the Service of the Community," opened last week and continues until July 28. It has been designed to explain in simple and effective terms to laymen the vital part electricity plays in modern life, but has not been limited to the activities of public authorities. Illustrating the latter point, models of the liner *Mauretania* and Brabazon aeroplane, so closely connected with the city, are exhibited with information concerning their electrical equipment. The various sections cover generation, distribution and domestic uses of electricity, its employment in industry, agriculture and transport and its associations with entertainment, public health and communications. In regard to the last mentioned, the G.P.O. will be taking a stand to illustrate the story of telecommunications during the past 100 years.

Public utilities and many well-known manufacturers have contributed to an attractive display of equipment: agriculture is featured with many pieces of apparatus including incubators, milking machines, soil warmers and electric fences; and methods of obtaining power from means other than the normal generators are illustrated by models of wind generators now being built in the Welsh Hills. On the lighter side, visitors may have an X-ray and also have their laundry done during washing machine demonstrations.

An effective lighting installation in spite of the use of exposed tubes, in the subway approach to Waterloo station. Fittings by Falk Stadelmann & Co., Ltd.

Lighting At Waterloo

PART of the plan for decoration of Waterloo station involved a new lighting installation in the approaches. This London terminus is probably the most convenient for visitors to the Festival of Britain exhibition, and it was, therefore, necessary to have a particularly effective and pleasing system. Fittings employed were supplied by Falk Stadelman and Co., Ltd., and in our accompanying illustration it will be noted that despite the comparatively low ceilings the streamlined battens have been used in which the lamps are exposed. The ceilings are, however, light and eye discomfort is, therefore, not apparent. Far from causing discomfort, the installation is, in fact, extraordinarily pleasant with a high standard of lighting achieved both in the subway itself and more important, on the stairs.

"Elmer" supplies Your Needs

PASSENGERS at Waterloo station will shortly be able to buy refreshments from Electric Elmer, a robot shopkeeper who, on the press-button system, will sell them up to 25 different articles. Elmer is

The first of three turbo-alternators has now been installed at Blackwall Point power station and will undergo a test run in the next few weeks. The three 30 MW generators made by English Electric Co. will have a combined output equal to 120,000 h.p., and the one installed is hoped to be in operation before the winter. The second is expected to be completed by the end of the year and the final set by next spring. Over 2,000 gallons of lubricating oil has been pumped into the generators storage tank by the Wakefield Co. The illustration shows the work in progress.

now on probation in the buffet but if he is popular will be employed on a larger scale. His ancestor, though smaller, was the 6d. self-service machine which readers may remember started to appear on railway stations just before the war. His goods include cigarettes, packed lunches, biscuits, fruit drinks and sandwiches at various prices. He will accept a round sum, let travellers push buttons all over the place and tell his customer how much is left. Press more buttons and the customer will be able to spend within a copper or two of the original outlay, but there is one snag—Elmer gives no change.

E.D.A. Film Honours

FURTHER international honours have been bestowed on E.D.A.'s series of educational films. One of the latest additions to the Association's library, "Electricity and Light," part of which is in colour, has been selected for the next Venice Film Festival. This film together with "Magnetism" and "Electrical Terms" will also be shown at the Edinburgh International Festival. Other international bookings for the above and additional productions include the Berlin and Cannes Film Festivals, and the International Scientific Film Association Congress at The Hague.

Electrocuted at Farm—£4,340 Award

THE electrocution of a Berwickshire farm steward when he placed his hand on a pole carrying electric cables to the farm at which he was employed, resulted in an award, totalling £4,340, being made in Edinburgh Court of Session last week to the wife of the deceased in respect of herself and her four children. The claim was made against the South West Scotland Electricity Board and the deceased's employer, Mr. A. H. Stobo. The husband, Mr. White, died in October, 1949, when he placed his hand on the pole and came in contact with a neutral earth band which was carrying approximately 240 V. It was alleged that the Board failed to take proper precautions to ensure that the neutral earth band did not become live. Stobo was blamed for installing an electric motor on the farm in such a way that danger was created, and for failing to give notice to the Board of his intention to install additional apparatus. The jury, by a majority of eight to four, apportioned the blame: 40% to the Electricity Board and 60% to Stobo.

Further Explanation Wanted

NO decision has yet been reached by Eastern Electricity Consultative Council on whether they should lodge a protest with the Central Authority concerning the increase of the fixed charge for domestic consumers from £2 8s. to £3. Following the report of a General Purposes Committee set up to consider the matter, the Council is to ask its Area Board for further information and figures substantiating the need for this increase. Although the necessitiy for greater income was fully appreciated, the chairman, Ald. W. J. Bennett, said at a meeting last week, it was felt that such an increase hit hard at the poorer classes. There seemed little justification for the Board's demand on the lower income groups, particularly as this had been their lot on three previous occasions since vesting day.

Ald. S. A. Bailey emphasised this point when he said of the £65,000 required, more than half has been levied on the "lower classes." He suggested an all-round increase of ¼d. per unit. In any case, industrial consumers should have been asked to bear more of the burden. A decision will probably be made at the Council's next meeting when figures have been obtained from the Board and considered. Having passed some remarks on the serious position facing the supply industry, the chairman warned members that at their next meeting they would probably be asked to state the effects of capital cuts in their particular districts.

Honour for Dame Caroline

THE Board meeting of the International Federation of Business and Professional Women which took place at The Hague recently was a memorable one for many of the delegates including the Federation's president, Dame Caroline Haslett. The president, together with 12 other officers representing some nine countries, were received in audience by H.M. Queen Juliana of the Netherlands. Dame Caroline told her royal host of the Federation's work and impressed her with the fact that she had taken up a career in the electrical industry. Before leaving she presented Queen Juliana with a leather-bound book prepared in connection with the Festival of Britain.

Tin Research

THE report on the work of the Tin Research Institute for 1950 has just been published. We learn that technical service and general development has proceeded satisfactorily and good progress has been made with a number of research projects. A notable achievement in the study of electro-deposition of tin-alloy coating was the invention of a new and attractive tarnish resistant electroplate consisting of 65% tin and 35% nickel. The report also covers work on corrosion tests, chemical analysis, and the manufacture of electrolytic tinplate.

"Goblin's" Golden Jubilee

JULY 4 is a notable date in the calendar and most people will immediately associate it with the signing of American Independence. But the date has also particular significance in the electrical industry for it marked the anniversary of the invention of the vacuum cleaner. The British Vacuum Cleaner Co., Ltd., celebrated the golden jubilee of this event on Wednesday last at the Savoy Hotel, and present at the function was the inventor himself, Mr. H. Cecil Booth, celebrating his eightieth birthday. Mr. Booth still takes an active part as chairman in the business he founded to promote the sales of his invention.

Mobile Showroom for Farmers

A NEW mobile showroom has been put into service by the N. of Scotland Hydro-Electric Board for use in the isolated parts of the area where electricity is being supplied for the first time. Due to the narrow roads over which it will be required to travel, there have had to be restrictions in the size of the vehicle, but these have been largely overcome by the inclusion of telescopic sides which expand to form bays for additional displays. The van will be connected by cable to overhead lines. Internal wiring facilitates demonstrations of equipment, which includes cookers, washing machines, vacuum cleaners, fires, lights and sundry other small appliances. There is accommodation inside the showroom for about a dozen people, but in view of impending visits to agricultural shows, provision has been made for the erection of an awning so that larger audiences can see the demonstrations. This up-to-date mobile showroom is expected to make its first public appearance on Saturday at Coupar-Angus Farmers Show, and after visiting similar shows in five other counties will be touring isolated farms and crofting townships in the area.

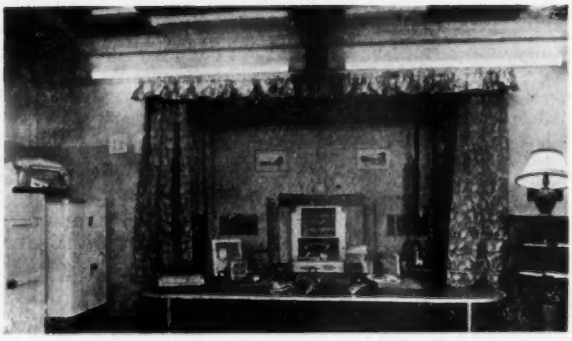
Production moved to Somerset

ORDERS have become so numerous for transformers, voltage regulators, specialised test equipment and switchgear at the Wimbledon factory of Foster Transformers and Switchgear Ltd., a company in the Lancashire Dynamo Group, that arrangements have been made to transfer production to Crypton Equipment Ltd., another firm in the same group. The latter is at Bridgwater in Somerset, a newly built factory on a seven-acre site offering scope for extensions where new equipment and tools are being installed to cope with the higher production rate needed. The Wimbledon staff will still be responsible for the contracts.

"Parents Day" at B.T.H., Willesden

FOLLOWING their 22-year-old custom, the Willesden Works of the British Thomson-Houston Co., Ltd., were "at home" last Saturday to the parents of serving apprentices, who thus had an opportunity to meet supervisors and heads of departments responsible for the welfare and training of their sons, and to see for themselves the kind of work they were doing, and to judge the prospects and conditions. More than 200 parents and guardians availed themselves of the opportunity, together with a number of principals and lecturers from London technical schools.

Following a tour of the works, and witnessing a number of working demonstrations, including the high voltage testing laboratory, they were entertained to tea and addressed by Mr. H. E. Cox (manager, B.T.H., Willesden), who explained the possibilities which electrical manufacturing held out. After a short explanation by Mr. H. Trencham (consulting switchgear engineer), the principal guest, Mr. E. S. Little (secretary and comptroller, B.T.H.) presented the awards for the essay competition and the Easthope Medal for the best essay of the year. Some comments on the system of transfer from craft to drawing-office courses were given by Mr. I. H. Child (apprentice supervisor) and a vote of thanks by Mr. B. J. Balkwill (acting chairman, Apprentice Association). The essay competition entry was smaller than usual but the subjects no less varied. The Easthope Medal was won by ex-apprentice M. H. F.



A view of the interior of the N. of Scotland H.E. Board's new mobile showroom which makes its first public appearance on Saturday. Note the extension with its sitting-room scene

H.M. the Queen photographed during her tour of the Royal Show at Cambridge last week. She is seen visiting E.D.A.'s stand "Electricity Farm." On the right is Mr. C. T. Melling, chairman of E.D.A.

Collins on the subject of "Current Transformers," while M. A. Permentiers took the fifth-year class with a paper on electric traction, as well as the competition shield for the most outstanding apprentice of the year.

NEWS IN BRIEF

A contract has been placed with Standard Telephones and Cables, Ltd., for the supply of 19 short-wave radio transmitters to the R.A.F. station at Nairobi. Thus the station will be able to handle every type of radio communication and will possibly be the largest service telecommunication centre outside Britain.

The E.A.W. has produced a small leaflet explaining its special course in electrical housecraft. Entitled "Electrical Education is the Key to Careers in the Modern World," it sets out the details of this course, the opportunities it provides and the training involved.

Members of the National Joint Board Negotiating Committee recently visited Yorkshire and were entertained by the Y.E.B. During their stay they found time to view the new television station at Holme Moss.

The Commercial Relations and Exports Dept. of the Board of Trade has a wide selection of trade literature issued by exhibitors at the annual exhibition of the National Restaurant Association of America, held at Chicago in May. They are available for loan to U.K. manufacturers.

Questions in Parliament

Interference

Questioned about meetings of the Advisory Committee set up under the Wireless Telegraphy Act, 1949, the Postmaster-General said the Committee considering ignition systems had met four times, the last being on April 9. The refrigeration apparatus committee had met three times, the latest, on February 26. There had also been eight meetings of sub-committees. Neither committee has yet submitted a report. He understood that there were still technical difficulties about the drafting of the report.

Nickel (Prohibited Uses)

The two recent Orders prohibiting the use of nickel in certain products were the subject of discussion last week when prayers to annul them were withdrawn after an assurance had been given that injury to export trade would be kept at a minimum. Moving the annulment of the Orders, Col. Banks considered that manufacturers would not be able to absorb or get rid of specially fabricated parts by September 30. There were also anomalies in the Order. According to the Orders, it would be possible to nickel-plate the radiator of a car but not the headlamp, a bumper bar but not an electric horn, a hub but not a rear lamp. Mr. Kaberry thought it might have been better to have allowed a lower general level of nickel content to ease the burden, rather than prohibit its use on certain articles. Miss Hornsby-Smith pointed out that the dollar market liked the chromium-plated finish. It would not be fobbed off with cellulose or other substitutes. The Order would have a disastrous effect upon the export trade of domestic appliances. These goods, for which we had won markets abroad, included a wide range of equipment in the domestic and commercial fields, including irons, radiators, toasters, vacuum cleaners, and refrigerators, small in their individual output but very large indeed in the aggregate and in the dollars they earned.

After others had spoken, Mr. M. Stewart, Parliamentary Secretary to the Ministry of Supply, said although there must be some impact on the export trade, the best had been done to see that injury was kept to a minimum. Some firms were likely to be hard hit, but it was not correct to suggest that a large number of small firms would face ruin. He was aware of some anomalies, such as in the car industry, but there the advice of the trade was followed. The Ministry were also prepared to deal with special cases by granting licences.

It might prove necessary to go somewhat further than the "prohibited uses" method, and introduce a more drastic scheme. The motion was by leave withdrawn.

Television Stations

The B.B.C. hopes to carry out test transmissions from Holme Moss television station this month,

and later to introduce test patterns to assist receivers and radio dealers in setting up and adjusting receivers, Mr. Ness Edwards announced in replying to a question by Col. Stoddart Scott. He said the B.B.C. also hoped to begin a regular programme service early in October. Earlier, Mr. Edwards reiterated the Government's decision to postpone the building of low-powered television stations near Aberdeen, Belfast, Newcastle, Plymouth and Southampton. Present plans were to complete Holme Moss, Kirk o'Shotts, and Wenvoe.

Scottish Hydro Schemes—Expenditure

Estimated cost of the Loch Sloy, Loch Morar and Lochalsh hydro-electric projects was £4,600,000 in 1944, Mr. H. McNeil, stated in a written reply to a question by Col. Gomme-Duncan. The Secretary of State for Scotland said he was informed that the expenditure on these projects to the end of May, 1951 was £9,043,000 and that the latest estimated cost of their completion—excluding those parts of the small Morar and Lochalsh scheme which have been postponed—was £9,235,000.

Electric Supply News

Ayrshire

At a meeting of the Ayrshire Burghs Association last week, Mr. A. E. Rootes, Manager of the Ayrshire Sub-area of the South West Scotland Electricity Board, was questioned about the Board's proposal to make a £15 service charge per house. In a letter, the Board had intimated that the average capital cost of connection per house was nearly £50, and therefore feel that a nominal contribution of £15 is reasonable. To meet those cases in which extended use is made of supply, that figure is reduced to £3 per house. When questioned, Mr. Roots said the average revenue from a house without an electric cooker was £4 10s. per year, but when a cooker was installed the revenue was increased by about £10. The association agreed to submit their questions in writing to the Board, and to give evidence, if necessary before the Convention of Royal Burghs.

Eire

Following our report last week of Mr. Lemass' statement in the Dail explaining the reason for tariff increases, the Electricity Supply Board has announced that the increase will take the form of a surcharge of 0·3d. per unit sold, except for night storage, where the addition is to be 0·2d. The estimated fuel bill would be £2,700,000 compared with £1,400,000 for much the same output last year. The new charge is expected to give an increase of about £700,000 or half the bill for this year, but makes no provision for increases in wages and salaries, recently agreed.

Isle of Man

Tynwald has voted another £30,000 to enable the Isle of Man Electricity Board to connect up a further 200 farms.

Lanarkshire

Part of a £3,000,000 rural development programme, the "switch-on" ceremony last week, in the isolated village of Chapelton, Lanarkshire, marked the completion of the first rural development scheme in the South West Scotland Electricity Board's Lanarkshire Sub-Area. In the Board's Area, 55% of the farms now have a public supply of electricity; this is believed to be the highest percentage in the whole of Britain. There are, however, nearly 5,000 farms and some 7,500 cottages and other rural premises without electricity and these are being dealt with under the new development programme which, it is hoped, will be completed by 1957.

Tottenham

The Borough Council Health and Housing Committee has reported that a new method of enclosing cables in the concrete screed of floors has been used satisfactorily on the Reynardsons Almshouses site on the Tewkesbury estate. The lines of cables are laid in tunnelling formed by rubber tubes which are inflated prior to laying the concrete. Later the "Ductubes" are deflated and withdrawn leaving a conduit into which the cables are pulled. We made reference to this system in our 9 February, 1950, issue.

LIGHTING SCHEMES

Aberdeen.—The Lighting Superintendent has recommended the installation of mercury vapour lighting in Great Western Road, at a cost of about £3,300.

Colne.—Approval has been given by the Ministry of Transport to the scheme for the electric lighting of the main road from the Colne-Nelson boundary to the Crown Hotel. Specifications are being prepared. Sodium lamps are to be used.

Guildford.—The T.C. is recommended to prepare a scheme for lighting the by-pass from Morris depot to Deerbarn Road.

Princes Risborough.—The parish council has agreed to purchase certain street lighting equipment in its area, from the Eastern Electricity Board, at a cost of £800.

Southgate.—A scheme to convert all street lighting in the borough to electricity has been accepted in principle by the Council.

Wandsworth.—The B.C. has been recommended to invite tenders for the supply of 100 street lighting columns, estimated to cost £1,000.

Wirral.—The U.D.C. is considering a scheme for street lighting of the Lower Village, Heswall, at an estimated cost of £3,488.

Company Activities

Associated British Engineering

The preliminary statement shows a profit for the year to March 31, subject to taxation, of £98,017 as against £91,225 for the previous twelve months. The final dividend is 12%, making 20% on the capital of £250,000 as increased by 25% bonus, compared with a total of 16% on smaller capital for 1949-50. The directors announce a scrip bonus of one new Ordinary 5s. unit for every five held.

Associated Electrical Industries Ltd.

Under the capital reconstruction plan, details of which were issued last week, the capital is to be increased from £8,696,050 to £10,000,000 by the creation of 303,950 4½% Cumulative "B" Preference shares of £1 each and 1,000,000 Ordinary shares of £1 each. In addition the 26,810 unissued 8% Cumulative Preference shares of £1 each are to be converted into "B" Preference shares. The authorised capital will then be £3,000,000 in Preference and £7,000,000 in Ordinary Stock. Existing Preference stockholders may, before October 1 next, convert all or part of their holdings into 4½% "B" Cumulative Stock. Holders thus converting will have the right to subscribe in cash at par for new Ordinary £1 shares in the ratio of three for every £10 of Stock converted. The new Ordinary shares will not rank for the interim dividend but will rank for the final Ordinary dividend of 1951. The directors also announce that it is intended to reduce the difference between the interim and final Ordinary dividends. It is proposed, earning permitting, to adjust payments in 1951 by declaring an interim of 7½%. This is not to be taken as implying that the total rate of dividend will be higher than for 1950. Meetings to consider the proposals are called for July 27.

E. K. Cole Ltd.

Group net profit for the year to March 31 last, according to the preliminary statements, is £155,050 (*£100,681*), after charging depreciation and £270,002 (*£133,005*) for taxation. There is a final dividend of 15% (*12%*), making 25% (*20%*).

A. C. Cossor Ltd.

A good recovery has been achieved by this well-known concern, as was indicated in the cautiously worded forecast last March when payment of one year's arrears of the 6% Preference was announced. For the year to March 31 last, the group trading profit is £481,169, compared with £247,760 for the preceding year. Depreciation interest, directors' investments, etc., absorb £106,568 (*£97,724*), to taxation £220,490 (*£49,300*), Preference dividend £15,750 (*nil*), to outside interests, etc., £11,188 (*£7,106*), and there is a surplus of £48,348 carried forward against a debit of £96,526 brought in. The volume of business expanded 30%, and, with the exception of 1945, the trading profit is the largest the company has ever made. The parent company's net trading profit amounts to £321,117 (*£114,659*) of which £170,499 is absorbed by taxation.

Drake and Gorham Ltd.

For the period July 1, 1950 to April 3, 1951, a group net loss of £5,857 was sustained, compared with a profit of £14,158 for the previous year. The figure includes estimated recoverable tax and unrequired provisions of £18,461, less £10,000 retained towards future tax and after tax on profits charged £13,100 (*£12,100*). With £41,413 (*£33,442*) brought in there is a balance of £35,556 (*£47,600*). Dividends, including 5% (*same*) on Ordinary, absorb £5,969 (*£6,187*), leaving £29,587 carried forward.

Electric Construction Co.

The full report shows a consolidated profit, etc., for the year to March 31 of £506,816 (*£475,263*). After charges, including audit fees, directors' emoluments, depreciation, reserve for contingencies, etc., the net profit, before taxation, is £222,069 (*£236,481*). To taxation, less excess provision in previous years £114,774 (*£126,788*), to reserve for income tax in respect of initial allowances £11,065 (*£10,800*), leaving a net profit applicable to Electric Construction Co. Ltd. of £97,369 (*£95,120*). With £47,505 brought in there is £144,874 available. To Preference dividend £3,763, transfer to superannuation fund, £20,000, to general reserve £20,000, to plant replacement reserve £20,000, written off shares in subsidiary £1,714, Ordinary dividend of 15% takes £27,145, leaving £52,252 carried forward.

Keith Blackman Ltd.

Trading profit for the twelve months ended March 31, £272,328 (*£238,916*) and with other income the total is £273,292 (*£239,645*). After charging all expenses, and making provision for depreciation, directors' fees, etc., there is a balance of £238,170 (*£208,736*), to which is added £59,659 (*£58,973*) brought in. To taxation £125,000, general reserve £20,000 (*£30,000*), reserve for pensions £15,000 (*£30,000*) and deferred repairs £6,000 (*£4,500*). The proposed Ordinary dividend of 22½% absorbs £35,437 (*£27,500*), and the Preference £6,050 (*same*), leaving £90,342 carried forward.

Madras Electric Tramways (1904)

For 1950, the profit was £1,600, compared with £800 for the previous year. After provision for renewals and replacements of assets £30,000 (*same*), there is £24,061 (*£24,493*) carried forward.

Marryat & Scott Holdings

For the period October 12, 1950 to March 31, 1951, net profit, before taxation, is £88,635. This compares with the forecast in the public information statement that profits would not be less than £80,000, before tax. The Ordinary dividend is at the rate of 22½% per annum. Taxation absorbs £46,622. The profit of the subsidiaries prior to acquisition was £126,469. After transfer to capital redemption reserve fund of £1,750, the sum of £14,708 is carried forward.

Commercial Information

CONTRACTS OPEN

HOME

July 13.—Malden and Coombe (Surrey) U.D.C. Supply and erection of 84 centrifugally spun concrete columns with 400 W mercury lanterns for Traps Lane and Coombe Lane. Borough Engineer, Municipal Offices, New Malden. (See June 28 issue.)

July 13.—Sutton and Cheam U.D.C. Erection of (a) 348 concrete columns, and (b) electrical equipment for 140 W sodium lamps, along seven miles of trunk roads A.217, A.232 and A.24. N. H. Michell, Borough Engineer and Surveyor, Municipal Offices, High St., Sutton, Surrey. Deposit £2 2s. for each contract.

July 13.—Torquay T.C. Supply and installation of diesel-driven automatic starting, electric generating plant to supply 4·5 kW at 230 V for Waterworks Dept. R. V. Toms, Water Engineer, Municipal Chambers.

July 14. — Macclesfield T.C. Supply and erection of 42 sodium lighting units on concrete columns for Hibel Rd., Gas Rd., Waters Green, and Sunderland St. T. H. Dossett, Borough Engineer, Town Hall. Deposit £2 2s. (See June 28 issue.)

July 14.—Rochdale. Alterations to lighting system and supply of new fittings at Balderstone Conservative Club in Harard St. Particulars from secretary.

July 16.—Durham. Provision of six and erection of 23 steel columns, mercury discharge lanterns and fittings, Group A, in Quarryheads Lane. City Engineer, Town Hall. Deposit £2 2s. (See June 21 issue.)

July 16.—Elgin. Supply and erection of electric street lighting units along Perth-Aberdeen-Inverness trunk road A.96. G. N. Blane, burgh surveyor, Weston House, Elgin.

July 16.—Hastings T.C. Electrical installation in 32 dwellings at Hollington, and also 12 dwellings in Winchelsea Road. Applications to Borough Engineer, 37 Wellington Sq. Deposit £2 2s. for each scheme.

July 16.—Lancashire. Electrical installation at Dalton-in-Furness branch library. G. Noel Hill, County Architect, County Hall, Preston.

July 16.—Morley T.C. Electrical work in 96 houses on Asquith Ave. estate and 10 on Central estates. Housing Director, M. H. Brook, National Provincial Bank Chambers, Queen St.

July 16.—Preston T.C. Electrical installation for proposed new traffic offices. Borough Engineer and Surveyor, Municipal Buildings. Deposit £2 2s. (See July 5 issue.)

July 16.—Stirlingshire. Electrical work in adaptations to hospital block at The Colony, Larbert. Applications to architects, Cullen Lochhead and Brown, 119 Cadzow St., Hamilton, by above date.

July 16.—Swansea T.C. Electrical installation at Mayhill primary school. Applications by above date to Borough Architect, The Guildhall. Deposit £2. (See June 28 issue.)

July 17.—Rochdale T.C. Electric lighting and power installation at passenger transport dept. workshops, Mellor St. Borough Surveyor, Town Hall.

July 18.—Bath. Electrical installation at Guildhall. Surveyor of corporate property, J. F. Bevan Jones, Guildhall. Deposit £2 2s.

July 18.—Manchester. Electrical installation at City Training College, Long Millgate. City Architect, Town Hall. Deposit £1 1s. (See June 21 issue.)

July 18.—Marshland (Norfolk) R.D.C. Installation of electricity in 22 houses on four sites. Architect is S. G. Bailey, Council Offices, Alexandra Rd., Wisbech.

July 19.—Halifax T.C. Re-electrification of the Ostler schools. Borough Engineer, Crossley St. Deposit £2 2s. (See June 28 issue.)

July 20.—Plymouth. Installation of electric lighting and power circuits in slaughterhouse and meat market. J. Paton Watson, City Engineer and Surveyor, City Engineer's Office, Guildhall. Deposit £2 2s.

July 20.—Sheffield. Electrical installation at Jordanthorpe secondary technical school. Applications to W. Geo. Davies, City Architect, Town Hall. Deposit £2.

July 21.—Dunbarton. Provision, erection and wiring of 89 street-lighting columns on trunk road A.82. Includes 83 concrete columns, four ornamental cast iron columns and two wrought iron brackets, with sodium lanterns and time switches. Applicants should communicate by above date with William T. Samson, 124 Bridge St., Alexandria, Dunbartonshire. (See July 5 issue.)

July 21.—N. Ireland. Supply and installation of underground cable system and electrical switchgear at Whiteabbey Hospital for N.I. Tuberculosis Authority. Applications to W. Harvey, Secretary, 27 Adelaide St., Belfast. Deposit £3 3s. in each case.

July 21.—Manchester. Electrical installation at evening school of domestic economy, Wilmslow Rd. City Architect, Town Hall. Deposit £1 1s. (See July 5 issue.)

July 23.—Norwich. Supply of one small electrically driven compressor set. S. N. Kelly, Engineer and Manager, Water Dept., City Hall.

July 23.—Goole T.C. Installation of H.P.M.V. sodium and tungsten Class A and B lighting on various roads in the borough. Thomas Waterfall, Borough Engineer, Municipal Offices. Deposit £1 1s. (Advertised in this issue.)

July 23.—Nottingham. Improved lighting scheme along 2,150 yd. of trunk road A.52 comprising concrete columns and 140 W sodium equipment. Lighting Engineer, 3 George St. Deposit £2 2s. (See July 5 issue.)

July 24.—Epping U.D.C. Supply and erection of 46 concrete standards with sodium-type equipment for street lighting improvements. Council's Surveyor, H. J. Mead, 91 High St. (See July 5 issue.)

July 26.—Liverpool. Installation of electric light and power wiring at Sefton General Hospital for S. Liverpool Hospital Management Committee. Applications to Secretary, Garnet

Chaplin, Sefton General Hospital, Liverpool 15.

July 28.—Esher U.D.C. Provision of 19 electric water heaters in houses at West Molesey. Engineer and Surveyor, Council Offices. Deposit £1 1s.

July 30.—Newbiggin-by-the-Sea U.D.C. Provision and erection of 95 standards, lamps and auxiliary equipment on roads A.197, B.1334 and other streets in the district. H. Selby Robson, Engineer and Surveyor, Council Offices. Deposit £2 2s.

July 31.—Durham. Electrical installation in Hartlepool West View new county school. Applications to County Architect's Office, Court Lane, Durham.

July 31—Scunthorpe T.C. Supply and erection of 21 concrete columns and wiring of 42 400 W mercury discharge lanterns along approx. 1,955 yd. of Ashby High St. Cyril Cooper, Borough Engineer and Surveyor, Comforts Ave., Scunthorpe. (Advertised in this issue.)

Aug. 2.—Swinton and Pendlebury T.C. Supply and erection of electrically driven centrifugal pump capable of 1,000 g.p.m. Borough Engineer and Surveyor, Town Hall, Swinton, Lancs.

Aug. [illegible]—Belfast. Supply and erection of a 6-ton travelling lifting semi-Goliath, manually operated gantry for handling circulating water screens, for Electricity Dept. Merz and McLellan, consulting engineers, Carliol House, Newcastle-on-Tyne. Deposit £5 5s. (See July 5 issue.)

Aug. 13.—Stepney. Installation of lighting, heating and power points in 77 dwellings at Vallance Rd. Borough Engineer and Surveyor, Municipal Offices, Duval St., E.1. (Advertised in this issue.)

Aug. 17.—Belfast. Supply and erection at Victoria power station of 3,300 V 150 MVA air or oil break switchgear, 400 V, 15 MVA air break switchgear, 400 V fuse gear and accessories. Also three centrifugal circulating water pumps each capable of 23,000 g.p.m. Merz and McLellan, consulting engineers, Carliol House, Newcastle-on-Tyne. Deposit £5 5s. for each specification. (See June 14 issue.)

Sept. 3.—Dublin. Electricity Supply Board invites tenders for supply, delivery and erection of one 30 MW steam-driven turbo-alternator set with condensing plant, feed heating plant and auxiliaries at Ringsend power station. Generation Engineer, 27 Lower Fitzwilliam St., Dublin. Deposit £5 5s. (See May 24 issue.)

No date stated.—Melrose. Electrical installation in erection of four blocks (12) houses in Priors Walk. John A. W. Grant, C.A., 36 Melrose St., Edinburgh.

No date stated.—Dudley T.C. Installation of electric lighting and power points in 811 houses on Priory estate, 257 on Wolverton Rd. site, 86 in Northfield Rd. and 34 on Woodside estate. Applications to Borough Architect, Priory Hall.

No date stated.—N. of Scotland H.E. Board. Supply and erection of approx. 25 miles of 11 kV and 26 miles of low voltage wood pole overhead lines, and about 1½ miles of cabling at Banchory Devenick and Old Machar, Aberdeenshire. Merz and McLellan, 39 Northumberland St., Edinburgh. Deposit £1 1s. (Advertised in this issue.)

No date stated.—Carnoustie T.C. Conversion from gas to electricity of some 50 houses. D. M. Paton, burgh surveyor. Deposit £1 1s.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

July 26.—New Zealand. Post Office requires supply of some 27,000 packets of insulated and ordinary staples of various descriptions. G.P.O., Stores Div., Wellington C.1. B.o.T. (Ref. CRE (IB) 64677/51).*

July 27.—S. Rhodesia. Tenders invited for private automatic exchange equipment and ancillary gear, together with sundry other items including batteries and constant voltage transformers, battery chargers and eliminators. P.O. Box 75, Causeway, Salisbury. B.o.T. (Ref. CRE (IB) 65130/51)*.

July 30.—India. Directorate General of Supplies and Disposals require supply of 905 miles of paper insulated lead sheathed dry core steel tape armoured unit type underground telephone cable, and 160 miles different sized telephone cables as above, unarmoured type but with jute serving over lead sheath. Shahjahan Rd., New Delhi.

Aug. 16.—S. Africa. Supply of 10,000 50 ampere porcelain pole fuse units to be used for control of supplies to consumers from 3-phase a.c. overhead distribution system, 380/220 V, for Cape Town Electricity Dept., Electricity House, Strand Street. B.o.T. (Ref. CRE (IB) 64500/51).*

Sept. 6.—Sydney. Manufacture, supply and erection of 11 kV

Your Queries — Answered

"Carlisle" immersion heaters, suppliers of? S.P.—Northern Industries, 20 Snowhill, Bradshaw St., Manchester 4. (20693)

"Lectross" heated clothes-stand, address for? J.M.—John A. Grey and Partners, Ltd., the makers, went out of business in 1950, but Electronic Precision Equipment, Electron House, Ruislip Manor, Middx., have advertised that they can supply new appliances and spares. (20708)

Thermostats external fixing, makers of? S.W.—British Thermostat Co., Ltd., Windmill Rd., Sunbury-on-Thames. Otter Controls, Ltd., Market St., Buxton. Magnetic Valve Co., Ltd., 28 St. James Place, S.W.1. (20716)

"Prilect" irons, makers of? C.B.—T. Price and Son (Stampers), Ltd., Spring Hill Passage, Birmingham 18. (20727)

"Clyde" clocks, suppliers of? W.E.—British and Foreign Agencies, Colven St., Bridgeton, Glasgow. (20735)

"Modernette" cookers, makers of? S.E.—This was the name used by Belling and Co., Ltd., Southbury Rd., Enfield (in 1935) and British National Electrics Ltd., Newarthill, Lanarkshire (in 1937). (20742)

The above are selected from questions we have answered this week. If you have a query, send it to us.

250 MVA metal-clad switching equipments for Concord and Banksmeadow substations; also supply of tools and appliances and maintenance of plant for 12 months. General manager, Sydney County Council, Queen Victoria Building, George St. B.o.T. (Ref. CRE (IB) 64895/51).*

Sept. 19.—Belgium. State Railways require 40 exterior type hand-operated disconnecting switches—nominal tension of 3,600 V d.c. and nominal intensity of 2,000 amperes. Societe Nationale des Chemins de Fer Belges, Direction du Materiel et des Achats, Hotel des Chemins de Fer, 21 rue de Louvain, Brussels. B.o.T. (Ref. CRE (IB) 64640/51)*.

Sept. 19.—India. Manufacture, supply and erection of turbines, generators and exciters, auxiliary turbine and generators, indoor switchgear and fire protection equipment for Dam Power House and Canal Power House. Superintending Engineer (Technical), 157 Mount Rd., Madras 2. B.o.T. (Ref. CRE (IB) 64768/51).*

CONTRACTS PLACED

B.E.A. 33 kV switchgear, Willesden, A. Reyrolle and Co., Ltd.; cables and accessories, Rye House, B.I.C.C.; coal handling plant, Babcock and Wilcox Ltd., and 132 kV 2,500 MVA switchgear, G.E.C., for Meaford "B"; generator and station transformers, Connah's Quay, C.A. Parsons and Co., Ltd.; cables, connections and lighting installation at Keadby, W. T. Henley's Telegraph Works Co., Ltd.; coal handling plant for Roosecote, Robert Dempster and Sons, Ltd.; condensing and feed-heating plants for two 30 MW turbo-generators at Fleetwood, Vickers-Armstrong, Ltd.; 132 kV 2,500 MVA switchgear, Stourport, G.E.C.; 132 kV overhead line between Hawarden and Bangor, B.I.C.C.; 132 kV overhead line from Bonnybridge to Devonside, J. L. Eve Construction Co., Ltd.; 275 kV double circuit overhead line, sections Clydes Mill to Stella, Blaydon-on-Tyne, and Thirsk, Yorks, to West Melton, Balfour, Beatty and Co., Ltd., and section Stella to Thirsk, B.I.C.C.

Doncaster. Installation of electrical works in 118 houses, A. H. Bowyer of Maltby, £3,330.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	234 0 0	£220 0 0
LEAD, good soft pig (foreign)	160 0 0	136 0 0
,, ,, ,, "English" quality ...	161 10 0	
TIN (99-99.75%) ... ...(Cash)	875-885	—
,, (3 months)	832½-835	—
ALUMINIUM, commercial purity (del.)	124 0 0	—
ZINC	160 0 0	140 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	47 10 0	—
Mild Steel Tape (0·04 in.)	26 10 0	—

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Cinetone. 697,851. Class 11. Projector lamps and carbons therefor. Cinetone Equipment Co. Ltd., 317 Euston Rd., N.W.1.

Cyclops. 697,784. Class 9. Fuse-holding devices incorporating an indicating lamp. Belling and Lee Ltd., Cambridge Arterial Rd., Enfield.

Genyk. 696,762. Class 6. Electric conduit tubing, elbows, tees junction and coupling fittings, etc. 696,763. Class 9. Junction boxes, switch boxes and mountings. Hygienic Wire Works Ltd., 79 Miles Rd., Mitcham, Surrey.

Mek-Elek. B697,028. Class 9. Electrical apparatus and instruments. B697,029. Class 11. Electric lighting installations. Mek-Elek Eng. Ltd., 17 Western Rd., Mitcham, Surrey.

Panda Equipment with design. 696,849. Class 9. Radio and television apparatus. Panda Radio Co., 58 School Lane, Rochdale.

Bema. 687,299. Class 9. Tester valves for checking the accuracy of pressure gauges on boilers, pressure gauges, apparatus for detecting cracks in steam boilers. British Engine Boiler and Electrical Insurance Co. Ltd., 24 Fennel St., Manchester 4.

Star. 695,185. Class 8. Electric shaving instruments. Ever-Ready Razor Products Ltd., Ever-Ready Corner, The Hyde, N.W.9.

TRADE NOTES

Tariffs.—Among changes in the Egyptian Customs Tariff, steam boilers, superheaters, electric generators, motors, transformers have been freed from import duty and the additional *ad valorem* duty on those goods is reduced to 1%.

New Branch Office.—Gent and Co., Ltd., have opened a branch office at Winchester House, Victoria Square, Birmingham. Tel.: Midland 6443. Mr. J. P. Devlin is in charge.

E.W.F.—R. A. Poole (London), Ltd., Cox St., Coventry, have been elected a member of the Electrical Wholesalers Federation.

Holidays.—The Cotswold works of Gillott Electro-Steam Cookers, Ltd., will be closed from July 27 to Wednesday morning, Aug. 8.

Change of Name.—Durex Abrasives Ltd. announce that the name of the company has been changed to Minnesota Mining and Manufacturing Co, Ltd.

The manufacture of self-adhesive tapes, magnetic recording tape, coated abrasives, adhesives and protective coating will continue as before.

The works of the Jackson Electric Stove Co., Ltd., at Clifton Rd., Luton, and the Darlaston works of Wellman Smith Owen Engineering Corpn. Ltd., will be closed from July 27 until Aug. 7.

Agent.—Standard Telephones and Cables, Ltd., announce that they have appointed A. W. Gordon, Ltd., 11 Gloucester St., Belfast, as their sole selling agents in Northern Ireland for rubber, plastic and textile insulated cables, power cables, SenTerCel selenium rectifier equipment, private automatic telephone exchanges, private automatic branch exchanges, intercommunicating telephones, fire alarms, power factor correction capacitors, R.F. heating equipment, railway signalling systems, staff calling systems, and remote control equipment.

BUSINESS PROSPECTS

HOME

Aberdeen T.C. It is proposed to build shops at Northfield and Kincorth (£50,000) for Northern Co-operative Society, 54 Loch St.

Berwick T.C. Various trades in construction of 24 houses at Gordon, Leitholm and Reston. Architects, J. and J. Hall, Ladhopevale, Galashields.

Bridgend U.D.C. Erection of 80 houses on West House site under two contracts of 45 and 35 houses. Engineer and Surveyor to Council, D. J. Amos, Glan-ogwr, Bridgend.

Brighton T.C. Tenders invited for erection of factory on Hollingbury estate for the Shipton Engineering Co., Ltd., manufacturers of electrical and pneumatic machine tools.

Coatbridge T.C. Application made for sanction to borrow some £266,870 for erection of a total of 184 houses.

Cockfosters. Middlesex C.C. recommended to approve renewal of electric lighting at Ludgrove Hall at estimated cost of £1,400.

Croydon T.C. Town planning permission has been granted for following building schemes: a church and hall on Monks Hill estate, 15 shops and maisonettes in Central Parade, factory extensions in Gloucester Rd. for Oliver Typewriter Manufacturing Co., Ltd., and rebuilding of Visco Engineering Co., Ltd's. factory in Stafford Rd. Also 17 houses to be built in Selsdon Park Rd. by New British Garden Estates Ltd., 141 Shirley Rd.

Dartford T.C. Construction of 104 dwellings under three contracts on the Temple Hill Neighbourhood Unit. Borough Surveyor, Barclays Bank Chambers, High St.

Derby T.C. Sanction has been given to borrow £350,080 for the erection of 206 houses on the Mackworth estate.

Douglas (I.o.M.) T.C. Scheme approved for construction of 162 houses on Willaston estate at estimated cost of £343,500.

Dunmow (Essex) R.D.C. It is proposed to build 34 houses and 4 flats on various sites in the district.

Durham. Application made for sanction to borrow £9,732 for supply of electricity to 336 houses in Sherburn Rd. and Hatfield View. Also plans approved for erection of 48 houses at Witton Gilbert and 59 at Belmont; it is proposed to build a further 28 houses on the latter site. Also erection of New Penshaw county primary school and adaptations to Elemore Hall special school. County Architect's Office, Court Lane, Durham.

East Ham T.C. Erection of block of 96 flats in Priory Rd. Chief Housing Officer, Town Hall, E.6.

Glasgow. Erection of three 10-storey blocks comprising 219 flats and two 4-storey blocks comprising 48 flats in Berryknowes Rd. Director of Housing, 20 Trongate, Glasgow C.1.

Greenwich. Council offers conversion from gas to electricity in council houses where tenant desires such a supply and is prepared to pay increased rent, in accordance with an estimate of Borough Engineer and Surveyor amounting to £7,754.

Hamilton. Dean of Guild Court has approved erection of extensions at school of Engineering, Burnbank.

Hawarden (Cheshire) R.D.C. Plans approved for erection of 225 houses and flats at Broughton.

Hertfordshire. Tenders expected to be invited shortly for erection of a new station (concrete prefabrication) at Carpenders Park for British Railways. Estimated cost, £90,000.

Hereford. Construction of 14 houses at Hunderton and 24 at Hinton. F. Margerison, City Surveyor, Town Hall.

Hornsey. Sixteen old persons' dwellings and 16 maisonettes to be built in Ashford Ave. G. A. Pentecost, Borough Engineer and Surveyor, Town Hall, N.8.

Hove T.C. Two-storey blocks of flats, totalling 84 flats, to be built on St. Helen's estate. Borough Engineer and Surveyor, T. R. Humble, Town Hall.

Lancashire. Approval obtained for erection of secondary modern school in Thatch Leach Lane —cost estimated at £179,520.

Midlothian. Thirty-six houses to be built at Pumpherston. County Architect, 32 Palmerston Place, Edinburgh 12.

Newton Abbot U.D.C. Erection of 42 houses on Buckland estate. Application to Surveyor's Office, 18 Devon Square.

Shoreditch. Tenders to be invited shortly for erection of three five-storey blocks of flats on Wenlock Barn estate. Plans approved for a six-storey block of 60 flats on Pitfield estate.

Walthamstow T.C. Approval granted for extensions to factory at Fingal Works, Staffa Rd., for Reliance (Cords and Cables) Ltd. Also rebuilding of shops in High St. for Evelyn Property and Investment Co., Ltd.

Wandsworth. Erection of 115 dwellings on Clapham Crescent site. Names to Town Clerk, Municipal Buildings, S.W.18.

Worcestershire. Erection of primary school at Halesowen has been approved.

Wrexham T.C. Plans in hand to erect 300 houses.

OVERSEAS

India. Mr. R. C. Patel, proprietor of Associated Colours and Chemicals Co., 204 Hornby Rd., Fort, Bombay, wants to obtain agencies for (among other items) electric motors other than fractional h.p. He is now in England and may be contacted: c/o National City Bank of New York, Waterloo Place, W.1.

The East Asiatic Co. (India) Ltd., P.O. Box 639, "Wavell House," Graham Rd., Ballard Estate, Bombay, wish to obtain representation of U.K manufacturers of air conditioning units, freon condensing units and air conditioning plant components. Interested firms should contact enquirer's London office, The United Baltic Corporation Ltd., 158 Fenchurch St., E.C.3.

Madagascar. Messrs. Netter and Co., Tananarive, wish to obtain agencies of U.K. manufacturers of small tools and machine tools.

New Zealand. Gaumont-Kalee (N.Z.) Ltd., St. James Building, Queen St., Auckland, are interested in obtaining U.K. agencies for wires and cables and electrical fittings.

U.S.A. Mr. Dale W. Perry of Tape Recording Industries, would like to act as distributor for U.K. manufacturers of tape recorders and tapes. Firms should contact Mr. Perry at the firm's address at Lansing, Michigan, which is 3335 East Michigan Avenue.

Lamps are among a range of goods sought by Mr. A. K. Baracat, 3,725 Fountain Terrace, Amarillo, Texas.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Cornwall Radio and Television Co. Ltd., Fore St., St. Agnes. D. G. Ferry of 1 Beachfield Ave., Newquay, has been appointed liquidator.

Ideal Electrical and General Engineering Co., Ltd. Meeting of members will be held at 49 and 50 Bradford St., Walsall, on Aug. 21 at 2.30 p.m. to receive liquidator's report.

Vermiculite Insulating Co., Ltd. Petition for winding-up presented on June 29 and directed to be heard at Royal Courts of Justice, Strand, W.C.2, on July 16. Interested parties should contact Cree, Godfrey and Wood, solicitors, 13 Gray's Inn Sq., W.C.1.

First Meeting

London. Jerome K. Jerome (Gosport) Ltd., wireless and electrical engineers. Meetings of creditors and contributories at Inveresk House, Strand, W.C.2, on July 13 at 2.30 and 3 p.m., respectively.

BANKRUPTCY ACTS

First Meeting

Croydon. Douglas and Valerie Inez Cromwell, electrical fittings and lampshade manufacturers, trading as "Cromwell and Co." at Hindsley Place, Forest Hill, S.E.23. Meeting at Central Buildings, Matthew Parker St., S.W.1, on July 16 at 11.30 a.m., and public examination at County Court, Scarbrook Rd., Croydon, on Sept. 20 at 10.30 a.m.

Manchester. Glynn C. Higgins, electrical engineer, 8 Carlton Rd., Whalley Range, Manchester. Meeting at Official Receiver's Office, 20 Byron St., Manchester, on July 17 at 11 a.m., and public examination at Court House, Quay St., on July 20 at 10.30 a.m.

Intended Dividends

London. Hannah Rose Aarons, electrical wholesaler, trading as "Radeo Co. (Wholesalers) Leyton" at 764 Lea Bridge Rd., and 35 Tallack Rd., S.E.17. Last day for receiving proofs, July 20. Trustee is Bernard Phillips, 76 New Cavendish St., W.1.

Dividends

Birmingham. Albert William Harber, electrician, trading at 1 Kathleen Place, Redditch. Supplemental dividends of 19s. 5d. in £ payable at Official Receiver's Office, Somerset House, 37 Temple St., Birmingham, on Aug. 8.

Release of Trustees

Derby. Leslie C. Overton, electrician of King St., Bakewell. Trustee was Alfred J. Rogers, Official Receiver, 22 Regent St., Park Row, Nottingham.

Manchester. William T. Spencer, electrician of 376 Oldham Rd., Newton Heath. Trustee was Fred Carter Ormrod, official receiver, 20, Byrom St., Manchester 3.

Receiving Orders

Brentford. Basil Frank Robbings, electrical engineer and contractor, trading as "Electric House" at 1,388, Greenford Rd., Greenford Green, Middx. Date of order, June 29.

Derby. Leslie R. Maisey, electrical contractor, trading as "R. Maisey" at 50 High St., Alfreton, Derbyshire, and 3 Main Rd., Jacksdale, Nottinghamshire. Date of receiving order, June 29.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Cyclo Engineering Ltd., 49 and 51 Whitehead Rd., Aston, Birmingham 6. Mechanical, electrical, hydraulic, aeronautical and general engineers; motor and motor vehicle, cycle and motor cycle manufacturers, etc. Cap.: £1,000. Dirs.: L. Camillis, W. Whitehouse and E. Camillis.

Design and Equipment (London), Ltd., 60 Bury Walk, Chelsea, S.W. Mech., elec., civil and general engrs., etc. Cap.: £100. Dirs.: not named. Subs.: H. Barker-Bland and Maria C. Barker-Bland.

A. Fanthorpe, Ltd., 6-8 Hepworth Arcade, Silver St., Hull. Manufacturers of and dealers in wireless and television sets, accessories and apparatus, etc. Cap.: £3,000. Dirs.: A. Fanthorpe and Mrs. L. Fanthorpe, and S. Dalby.

Freddies Auto Electricians (Blackpool), Ltd., 2 Moon St., Blackpool Cap.: £2,000. Dirs.: F. W. Edmondson and Mrs. M. Edmondson.

Kleestron, Ltd., West Halkin House, West Halkin St., S.W.1. Manufacturers of and dealers in a plastic moulding powder known as polystyrene, and all or any other forms of plastic products, synthetics, products of oil and petrol, etc. Cap.: £100,000. Dirs.: O. Kleeman, D. Kleeman, J. Kleeman and J. Mathie.

Nelsonian Products, Ltd., 3 Broad St. Bldgs., Liverpool St., E.C.2. To accept a licence of and/or to acquire letters Patent No. 637696 granted to David Rose in respect of "Improvements in or relating to devices for preventing knotting or twisting of electrical flex", etc. Cap.: £1,000. Dirs.: A. Nelson, R. V. Stephens, and D. Rose.

Simmonds and Stokes (Niphan) Ltd., Victoria Hse., Southampton Row, W.C.1. To acquire the whole or any part of the undertaking, assets and liabilities of Simmonds and Stokes, Ltd. (in vol. liqdn.), electricians, mech. engrs., etc. Cap.: £50,000. Dirs.: B. S. Simmonds, F. W. Mellows, E. A. Mills and W. C. James.

Talbot Electric Supplies and Engineering Co., Ltd. Cap.: £100. Dirs.: to be appointed by subs. Subs.: A. J. Gear and Freda S. Thom, 17 Shaftesbury Ave., W.1.

Tele-Services (Stockport) Ltd., 173-5 London Rd., Hazel Grove Cheshire. Manufacturers of and dealers in wireless goods, radio and television receivers and transmitters, etc. Cap.: £10,000. Dirs.: G. E. Samways and S. Hackett.

MEETINGS TO NOTE

THURSDAY, JULY 12

INCORP. PLANT ENGRS. (Newcastle Branch).—"Oil in Industry." I. A. Howden of Shell-Mex and B.P. Ltd., 8 Oxford St., 7.30 p.m.

FRIDAY, JULY 13

E.I.B.A.—Annual meeting and council at I.E.E., Savoy Place, W.C.2, 11.30 a.m.

MONDAY, JULY 16

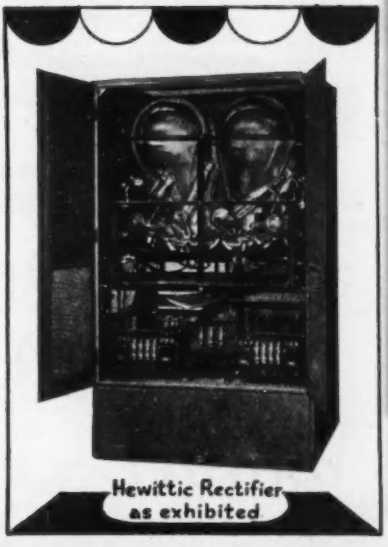
INTERNATIONAL CONFERENCE ON AUTOMATIC CONTROL IN INDUSTRY. Opens at Aeronautical College at Cranwell. Ends on July 21.

WEDNESDAY, JULY 18

FESTIVAL SHIP "CAMPANIA" will be open to public at Bristol between this date and July 28.

HERE in the General Electronic Section under the Dome of Discovery you will find a fine example of a modern electronic power unit—the Hewittic mercury arc rectifier—the equipment used for all forms of D.C. electric traction, light and power, and heavy duty industrial supply.

Hewittic Rectifiers
REGD. TRADE MARK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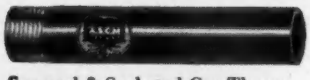
HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD., WALTON-ON-THAMES, SURREY

Telephone: Walton-on-Thames 760 (8 lines) Telegrams: "Electric," Walton-on-Thames

"It's no trouble at all!"



Screwed & Socketed Gas Thread

Screwed & Socketed Conduit Thread

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How often one hears that remark but how *true* it is when you are working with Metallic Conduit Tube and Fittings. For quality and consistent accuracy—

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Also at London, Newcastle-on-Tyne, Leeds, Swansea and Glasgow

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. 0d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

BOROUGH OF SCUNTHORPE

STREET LIGHTING TENDERS

Ashby High Street, Scunthorpe

TENDERS are invited for the lighting to Group A standard of approximately 1955 yards of the above road.

The works include:

(a) The supply and erection of 21 reinforced concrete street lighting columns.

(b) The supply, erection and wiring of 42 by 400-watt mercury discharge lanterns.

Specifications and forms of tender may be obtained from, and the drawings inspected at, the office of Mr. Cyril Cooper, A.M.I.C.E., Borough Engineer and Surveyor, Comforts Avenue, Scunthorpe, Lincs.

Tenders, in plain sealed envelopes endorsed "Ashby High Street Lighting Scheme," must be received by the undersigned not later than 10 a.m. on Tuesday, July 31, 1951.

The Council do not bind themselves to accept the lowest or any tender.

W. P. ERRINGTON,
Town Clerk.

Municipal Offices,
34 High Street,
Scunthorpe, Lincs.
July 2, 1951. (L 348)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Aberdeen Area

11kV AND LOWER VOLTAGE DISTRIBUTION LINES
CONTRACT No. AC/AN/7

TENDERS are invited for the supply, delivery and erection of approximately 25 miles of 11 kV and 26 miles of low voltage wood pole overhead lines, and approximately 1½ miles of cabling, in the Parishes of Banchory Devenick and Old Machar, Aberdeenshire.

Copies of the tender document may be obtained on application to the Engineers, Messrs. Mers and McLellan, 39 Northumberland Street, Edinburgh 3, on and after July 9, 1951. Applications should be accompanied by a cheque for £1 1s. which will be refunded on receipt of a bona fide tender.

The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Terrace,
Edinburgh 3.
July 2, 1951. (L 337)

BOROUGH OF GOOLE

STREET LIGHTING INSTALLATIONS

TENDERS are invited for the installation of H.P.M.V. sodium and tungsten Class "A" and Class "B" lighting on various roads in the borough.

Plans and conditions of contract may be inspected at the office of Mr. Thomas Waterfall, M.I.Mun.E., Borough Engineer, Municipal Offices, Goole, from whom forms of tender, specification and bills of quantities may be obtained on payment of £1 1s., returnable on receipt of a bona fide tender and return of documents issued.

Tenders, in plain envelopes endorsed "Street Lighting," to reach me by Monday, July 23, 1951.

The Corporation do not bind themselves to accept the lowest or any tender.

K. H. CHORLTON,
Town Clerk.

Municipal Offices,
Goole.
July 4, 1951. (L 347)

METROPOLITAN BOROUGH OF STEPNEY

INSTALLATION OF ELECTRIC LIGHTING, HEATING AND POWER, ETC., AT THE 77 DWELLINGS IN TWO BLOCKS OF FLATS TO BE ERECTED AT THE VALLANCE ROAD RECONSTRUCTION SCHEME

Contract No. 695.

NOTICE is hereby given that the Council of the Metropolitan Borough of Stepney will receive tenders from such persons as may be willing to enter into a contract for providing all necessary labour and materials required for the installation of the electric lighting, heating and power points at the above-mentioned housing scheme.

The House of Commons Fair Wages Clause will apply.

Contractors will be prohibited from assigning or underletting their contract without the written consent of the Council previously obtained.

The drawings and documents are to be inspected at the Council's offices by persons desirous of submitting tenders, prior to making the deposit hereunder, in order to satisfy themselves that they can undertake the work.

Copies of stipulations (including form of tender), schedules, specifications and plans of the buildings may be made upon application to A. A. Hudson, Esq., A.M.Inst.C.E., A.R.I.C.S., M.I.M.E., A.M.I.Struct.E., A.M.T.P.I., Borough Engineer and Surveyor, Municipal Offices, Duval Street, E.1, upon payment of a deposit of £5, which will be refunded to bona-fide tenderers (subject to the return of all plans and documents issued).

Tenders and documents, etc., sealed in the envelopes supplied, must be forwarded to the undersigned so as to arrive at this office not later than Monday, August 13, 1951.

The Council do not bind themselves to accept the lowest or any tender, and the acceptance of a tender or tenders will be subject to the obtaining by the Council of any requisite consents.

By order of the Council,

J. E. ARNOLD JAMES,
Town Clerk.

Municipal Offices, London Fruit Exchange,
Duval Street, E.1. (L 384)

APPOINTMENTS VACANT

NOTTINGHAMSHIRE COUNTY COUNCIL

County Architect's Department

APPLICATIONS are invited for the superannuable appointment of two Electrical Engineering Assistants on the permanent staff. Salary £600 by £20 to £960 per annum.

Candidates must have had a sound technical training in electrical engineering and practical experience in the electrical contracting industry, especially on installation and maintenance of electrical services in schools. They must be capable of preparing plans and specifications for the installation of electric lighting and power services in schools and other public buildings. Preference will be given to Corporate Members of the Institution of Electrical Engineers.

Application forms and further particulars are obtainable from the County Architect, County Hall, Trent Bridge, Nottingham, to whom completed applications must be returned by July 27, 1951. Canvassing will disqualify.

K. TWEEDALE MEABY,
Clerk of the County Council.
(L 377)

DEPARTMENT OF POSTS AND TELEGRAPHS, DUBLIN

VACANCIES FOR TEMPORARY ASSISTANT ENGINEERS

APPLICATIONS are invited for the above-named posts.

Rate of remuneration: £483 per annum, which may be increased in exceptional cases where candidates have had special experience or possess special qualifications.

Age limits: 21 to 30 years on April 1, 1951. An extension of the upper age limit may be allowed in the case of persons with certain specified service in the Irish Defence Forces or in the Irish Auxiliary Defence Services.

Essential qualifications: Each candidate must (1) have passed the Final Examination for a University Degree in Engineering and have qualified in a technical electrical engineering subject in that examination, or (2) have passed the Final Examination for a recognised University Degree in Science, the approved course of study for which is at least four academic years, and have pursued an honours course in experimental physics and have qualified in that subject in the Final Examination, or (3) hold a recognised University Degree in Science, having qualified in experimental physics in the Final Examination for such Degree, and, in addition, have qualified for a higher degree in Science or have been engaged for at least one year in full-time employment in approved practical work in electrical engineering or telecommunications or work in electronics associated with these two fields, and (4) have a knowledge of mathematics at least equivalent to that required to obtain honours in that subject at the Department of Education Secondary School Leaving Certificate Examinations.

Employment will be for not less than six months. It is expected that there will shortly be a competition held by the Civil Service Commissioners for permanent posts as Assistant Engineer on a scale of £430 per annum to £800 per annum plus the percentage additions under the Arbitration Award, amounting to £53 per annum at the minimum and £90 per annum at the maximum. Serving Temporary Assistant Engineers who are qualified will be eligible to sit for these posts.

Applications, giving particulars of age, qualifications and experience, should be addressed to the Engineer-in-Chief, Department of Posts and Telegraphs, Leitrim House, Dublin. The closing date for the receipt of applications will be July 26, 1951. (L 383)

ELECTRICITY SUPPLY BOARD

VACANCIES FOR ENGINEERS

THE Electricity Supply Board invites applications from suitable candidates for positions on its graded engineering staff. The grade applicable to the posts is VIIA, the basic salary scale (i.e. exclusive of bonus) of which is £430 by £22 to £760 per annum. The commencing salary will be not less than £483 per annum, inclusive of cost-of-living bonus, and may be higher in the case of candidates who have had previous engineering experience. Appointments will be on a probationary basis for twelve months and will be subject, in each case, to a satisfactory medical report. Successful candidates will be required to join the Board's Superannuation Scheme, subject to acceptance by the Superannuation Committee.

Applicants will be required to hold a University Degree in Electrical and/or Mechanical Engineering, or its equivalent.

Applications which should clearly set out age and details of candidates' technical qualifications, training and experience, should be addressed to Personnel Officer, Electricity Supply Board, 27 Lower Fitzwilliam Street, Dublin, so as to reach that address not later than Thursday, 26th instant.

PATRICK J. DEMPSEY,
Secretary.

July 6, 1951. (L 367)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the position of SHIFT CONTROL ENGINEER at the Staythorpe Generating Station.

Applicants should have a sound training and practical experience in a modern generating station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be advantageous.

The salary will be in accordance with Class "J" Grade 10 of the National Joint Board Schedule, and the post will be superannuable under the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity House, Barker Gate, Nottingham, and should be delivered to the undersigned not later than July 27, 1951.

L. F. JEFFREY,
Divisional Controller.

British Electricity Authority,
British Electricity House,
Barker Gate, Nottingham. (L 363)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Edinburgh Sub-Area

APPLICATIONS are invited for the following posts:—

(a) TWO ASSISTANT DISTRICT ENGINEERS

Applicants should have a sound technical training. Their duties will consist of the operation and maintenance of an underground supply system up to 33 kV, including direct current networks, rotary and transformer substation plant, fault location and protective gear testing.

The successful applicants will require to undertake standby duties.

The salaries for the posts will be in accordance with the National Joint Board revised schedule, Class "F," Grade 7—£625 to £643 per annum.

(b) ONE THIRD ASSISTANT ENGINEER (Planning and Development)

Applicants should have a sound technical training and experience in the construction and operation of underground cable systems and substations in urban areas at voltages up to and including 33 kV.

Experience in the preparation of reports and estimates for cable networks and substation design, including load flow and fault calculation, would be an advantage.

The salary for the post will be in accordance with the National Joint Board revised schedule Class "H," Grade 10—£571 to £597 per annum.

The above positions are superannuable and the successful applicants will be required to undergo a medical examination.

Applications, in writing, stating age, education, qualifications, experience, present position and salary, should be received by the undersigned within 14 days of the appearance of this advertisement.

G. T. ALLCOCK,
Edinburgh Manager.

Dewar Place,
Edinburgh 3. (L 375)

BRITISH ELECTRICITY AUTHORITY

South Western Division

APPOINTMENT OF STATION SUPERINTENDENT—PLYMOUTH "B" GENERATING STATION

APPLICATIONS are invited for the appointment of Station Superintendent at the new Plymouth "B" Generating Station, Plymouth, Devon.

In the first instance the station will have a capacity of 94.5 MW and will ultimately be increased to 189 MW.

Applicants should have had a good technical education and considerable practical experience in the operation, maintenance and administration of a modern generating station. Experience with pulverised fuel fired boilers will be considered an advantage.

Preference will be given to candidates who are Corporate Members of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers or who hold equivalent qualifications.

The salary will be in accordance with Grade 1, Class "G" of Schedule "A" of the N.J.B. Agreement, £1,069 to £1,119 per annum.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications, stating age, qualifications, present appointment and salary, and full details of education and experience, should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, 28 Oakfield Road, Bristol 8, so as to be received not later than August 3, 1951.

R. C. BARRETT,
Divisional Secretary.

July 7, 1951. (L 382)

BRITISH ELECTRICITY AUTHORITY

ASSISTANT IN THE CENTRAL INFORMATION SERVICE HEADQUARTERS, LONDON

APPLICATIONS are invited for the above appointment, in the Secretary's Department at Headquarters.

The work will largely consist of indexing and abstracting technical publications of interest to the electricity supply industry. It will also involve a certain amount of translating, together with information searches on particular subjects.

Candidates should possess some knowledge of engineering and scientific subjects, together with experience in the translation from at least one foreign language. Knowledge of Russian would be an advantage.

Salary will be in accordance with experience and will be within Grade 3 of the National Joint Council (Administrative and Clerical) Grades, i.e. £480 plus £20 per annum, to £540 p.a. inclusive of London allowance.

Letters of application, stating age and giving details of experience, should be forwarded to D. Moffat, Director of Establishments, British Electricity Authority, British Electricity House, Great Portland Street, London W.1, to be received not later than July 27, 1951.

Please quote reference AE/190. (L 355)

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

MAINTENANCE ENGINEER (ELECTRICAL)—FERRYBRIDGE POWER STATION

APPLICATIONS are invited for the above appointment at a commencing salary of £751 per annum in accordance with Class "H," Grade 6 of the National Joint Board Agreement.

Applicants should have had a wide experience of power station electrical equipment and practical experience of e.h.t. switchgear and protective gear. Preference will be given to candidates who are corporate members of the Institution of Electrical Engineers or who hold equivalent qualifications.

The appointment will be subject to conditions of service in accordance with the National Joint Board Agreement and will be superannuable under the Authority's scheme.

Forms of application may be obtained from the Divisional Secretary, British Electricity Authority, Yorkshire Division, British Electricity House, St. Mary's Road, Leeds 7, to whom completed forms must be returned within 14 days of the appearance of this advertisement. Envelopes to be endorsed "Maintenance Engineer (Electrical)".

G. A. VOWLES,
Divisional Controller.

July 4, 1951. (L 361)

MIDLANDS ELECTRICITY BOARD

Birmingham and District Sub-Area

APPOINTMENT OF DISTRICT DRAUGHTSMAN

APPLICATIONS are invited for the position of District Draughtsman in the North Eastern District of the above Sub-Area.

The successful applicant will be required to take charge of the District Drawing Office and must be fully conversant with up-to-date methods of compiling accurate records of distribution and substation plant alterations and extensions, and able to prepare other drawings associated with this class of work.

The salary and conditions of service will be in accordance with the National Joint Council Grade 3, £450 to £510 per annum.

Applications, giving age, and particulars of qualifications and experience, should be submitted within seven days of the publication of this notice, in a sealed envelope endorsed "District Draughtsman," and directed to the undersigned. Emil Braathen, Manager, Birmingham and District Sub-Area, 14 Dale End, Birmingham 4.

July 5, 1951. (L 378)

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following post:—

SENIOR ACCOUNTING ASSISTANT (Expenditure) Isle of Wight District of No. 3 (Portsmouth) Sub-Area. Salary, N.J.C. Grade 4 (£510 to £570 per annum), N.J.C. conditions of service.

Applicants should possess adequate experience in all branches of accountancy work at District level. The successful candidate will be responsible to the District Accounting Officer for all matters relating to expenditure and costing. The possession of a recognised accountancy qualification will be an advantage.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth and returned to him not later than July 23, 1951.

F. W. KEMPTON,
Secretary.

July 12, 1951. (L 373)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the position of ASSISTANT ENGINEER (EFFICIENCY AND TESTING) at Freemen's Meadow Generating Station, Leicester.

Candidates should possess a Higher National Certificate in engineering, or equivalent qualification, and have had experience in the operation and control of modern power generating stations.

The salary will be in accordance with the N.J.B. Agreement, Class "H," Grade 11, at present £538-£558. The post will be superannuable within the provisions of the British Electricity Authority and Area Boards superannuation scheme.

Applications should be submitted on the official form, which may be obtained from the Divisional Establishments Officer, Barker Gate, Nottingham, and be returned not later than July 27, 1951.

L. F. JEFFREY,
Divisional Controller.

The British Electricity Authority,
British Electricity House, Barker Gate,
Nottingham. (L 362)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment:—

STATION SHIFT CONTROL ENGINEER—Little Barford Generating Station

Salary in accordance with the N.J.B. Schedule "A," Grade 10, Class "G," (£539-£561 per annum).

Applicants should have reached the standard of Ordinary National Certificate in Electrical Engineering or its equivalent, have experience in the operation of a switchboard at a generating station and be fully conversant with high tension switching operation and protective systems.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London N.14, to arrive not later than July 21, 1951. Envelopes should be endorsed "Station Shift Control Engineer—Little Barford."

W. N. C. CLINCH,
Controller.

Northmet House, Southgate, London N.14. (L 360)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Ayrshire Sub-Area

APPOINTMENT OF DISTRICT ENGINEER

APPLICATIONS are invited for the position of District Engineer in the Ardrossan District of the above Sub-Area.

Applicants should have received a sound technical and practical training, and have long and comprehensive experience, including planning, construction, operation and maintenance of overhead and underground networks and sub-stations up to and including 33 kV.

Corporate Membership of the Institution of Electrical Engineers or equivalent qualifications essential.

Salary in accordance with the N.J.B. Agreement, Class "E," Grade 2, £856 to £896 per annum, and the position superannuable in accordance with the B.E.A. and Area Boards' Scheme.

An attractive four-room bungalow will be available, situated in Saltcoats, to the successful married candidate at a yearly rental of £33.

Applications, stating age, whether married or single, qualifications, and giving full details of education, training, experience and present position, to be sent to the Manager, South West Scotland Electricity Board, Greenholm Street, Kilmarnock, within 14 days of the appearance of this notice.

July 5, 1951. (L 379)

WAR DEPARTMENT

C.R.E. Shoeburyness

CLERK OF WORKS

A VACANCY exists in the office of the C.R.E., Shoeburyness, for a temporary Clerk of Works, Technical, Grade III (Electrical) (male).

Applicants 21 years of age and over must have experience in the preparation of draft drawings and specifications of lighting, heating and power in buildings of all types. Ability to supervise and control electrical installations and to carry out necessary tests on completion is essential. Experience in the installation of supply cables, terminations and metering and the possession of the City and Guilds Certificate in electrical installations would be additional qualifications.

Salary payable will be on a range of £460 (linked to age 26 years) by increments of £20 to £575 a year (London Rate), less provincial deductions ranging from £20 a year at the minimum to £30 a year; starting pay on entry will be determined by age, one increment being deducted or added for each year below or above age 26 years, subject to a maximum addition of two increments.

Letters of application, giving details of age, previous experience and qualifications, should be addressed to the C.R.E., Old Ranges, Shoeburyness, Essex. (L 376)

MIDLANDS ELECTRICITY BOARD

DEMONSTRATORS REQUIRED. Applicants must have had a good general education and the possession of a recognised Diploma in Domestic Science and Electrical Housecraft will be an advantage. Candidates must be able to conduct lecture demonstrations, both in the service centres and on consumers' premises and to advise consumers on the selection and use of electrical apparatus.

Salary and conditions of service will be in accordance with the National Joint Council Grade 1 within the range of £310 to £350 per annum, with further progress to £390 dependent upon a certificate of capability.

Applications, stating age, education and qualifications, should be forwarded within fourteen days to Sub-Area Manager, Midlands Electricity Board, 88 High Street, Worcester. (L 338)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the following appointments at the Bromborough Power Station, Cheshire:
(a) STATION CHEMIST—Class "H," Grade 7, £692 to £722 p.a.
(b) JUNIOR STATION CHEMIST—Class "H," Grade 16, £393 to £407 p.a.

Applicants for (a) should have experience in modern power station laboratory work covering the analysis of fuel, water and oil. The possession of a University Degree, A.R.I.C. or equivalent qualifications is essential.

Applicants for (b) should have a sound comprehensive practical training in chemical laboratory work. The possession of the Higher National Certificate or equivalent qualification would be an advantage. Salary for this appointment should be regarded as provisional pending confirmation by the National Joint Board.

The appointments will be superannuable under the British Electricity Authority and Area Boards' Superannuation Scheme and may be subject to medical examination.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and should be returned to him not later than Monday, July 30, 1951.

A. R. COOPER,
Divisional Controller.
(L 380)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT MECHANICAL MAINTENANCE ENGINEER —NORTH WILFORD GENERATING STATION, NOTTINGHAM

APPLICATIONS are invited for the position of Assistant Mechanical Maintenance Engineer (Boiler House) at the North Wilford Generating Station.

Applicants should have had a thorough mechanical training and possess considerable experience in the maintenance of all types of boiler house equipment found in large generating stations. Preference will be given to engineers with experience of pulverised fuel plants and the possession of an Ordinary National Certificate in Mechanical Engineering, or its equivalent, would be advantageous.

The salary is in accordance with Class "K," Grade 8, of the National Joint Board Schedule and the appointment will be superannuable under the terms and conditions of the British Electricity Authority and Area Boards' superannuation scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned not later than July 18, 1951.

L. F. JEFFREY,
Divisional Controller.
(L 304)

EASTERN ELECTRICITY BOARD

Northmet Sub-Area

DEMONSTRATOR—STEVENAGE DISTRICT (Ref. 294)

APPLICATIONS are invited for the appointment of a Demonstrator in the Stevenage District of the Northmet Sub-Area.

Candidates should have had Domestic Science training, including electrical housecraft, and should preferably hold the E.A.W. Certificate. They should be competent to plan and give cookery demonstrations, including lectures and advice to consumers on the utilisation of domestic electrical appliances. Previous experience in an Electricity Service Centre is desirable.

The salary for the appointment will be in accordance with Grade 1 (£310 p.a. by £20 to £390 p.a.) of the National Joint Council Salary Agreement, dated March 23, 1950. Both future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme, and may be required to undergo a medical examination.

Applications, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the District Manager —Stevenage, Eastern Electricity Board, 38 High Street, Stevenage, Herts, within fourteen days of the appearance of this advertisement. (L 374)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

SOUTH EASTERN ELECTRICITY BOARD

Central Sussex District

ASSISTANT ENGINEER

SALARY of £519 to £531 under the N.J.B. Schedule, Class "E," Grade 9. Superannuation will be arranged. Applicants must hold as a minimum technical qualification the Higher National Certificate in Electrical Engineering and should have had sound training and experience in distribution engineering up to 33 kV, preferably on overhead and underground systems in rural conditions. The person appointed will be considered for the tenancy of a flat.

Applications, giving two referees, must reach A. M. Harker, M.A.(Cantab), Central Sussex Manager, South Eastern Electricity Board, Electra House, Church Road, Haywards Heath, Sussex, by July 23, 1951.

A. L. BURNELL,
Secretary.
July 6, 1951. (L 381)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Northern Area

APPLICATIONS are invited for the post of GENERATION ENGINEER at Wick. Applicants must have a minimum of 10 years' experience in operating and maintaining diesel engines. Familiarity with public supply conditions desirable. Salary depending on qualifications and experience and subject to adjustment by the appropriate negotiating machinery. Superannuation scheme will apply. Applications to be forwarded to the Secretary, 16 Rothesay Terrace, Edinburgh 3, within seven days of the appearance of this advertisement. (L 390)

APPLICATIONS are invited from recently qualified YOUNG MEN with good Honours Degrees in electrical and mechanical engineering for initial further practical training in this country prior to overseas service with large Middle East oil company. Must be single. Pensionable posts, carrying substantial salaries and allowances. Write, quoting No. 96, to Box 5044, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (L 350)

ASCO Ltd., are prepared to appoint SALES AGENTS for commercial refrigeration equipment in selected territories.—Asco Ltd., Refrigeration Division, Broadheath, nr. Manchester. (K 737)

ASSISTANT BUYER, 40-45 years, experienced all phases buying, manufacture electrical products. Commencing salary £750.—Full particulars, Box No. 8027, Electrical Times. (L 353)

ASSISTANT DESIGNER required in Capacitor Dept. Duties will include the design of L.T. and H.T. capacitors for industrial purposes, preparation of power-factor correction schemes, etc. Candidates should have sound electrical training and experience, and hold Higher National Certificate or other qualifications. Five-day week. Good conditions. Pension scheme. Sports facilities.—Applications, stating age, training, experience and salary expected, should be addressed to Employment and Welfare Manager, Johnson & Phillips, Ltd., Charlton, S.E.7. (L 274)

CONTRACTS ENGINEER for London contractor specialising in excavating, cable laying and jointing. Duties to include estimating, preparation of technical specifications and supervision of contracts. Good technical background essential. Reply, giving full particulars, stating experience, salary required, and age.—Box No. 8037, Electrical Times. (L 385)

DESIGN DRAUGHTSMAN required by old-established firm of automatic electric control gear manufacturers in Home Counties. Experience in design of automatic contactor gear essential. Modern factory, 5-day week, canteen, incentive bonus, superannuation scheme. —Write, stating age, experience and salary required, to Box No. 8013, Electrical Times. (L 303)

DESIGN ENGINEER required by successful old-established company in the North of England, engaged particularly in the manufacture of heavy duty d.c. switchgear. He should have scientific and commercial qualifications as well as practical experience, originality and initiative. He would have unlimited opportunity for developing his ability at a good salary, rising without limit according to his performance. To the right man the future prospects are bright.—Box No. 6079, Electrical Times. (K 805)

DRAUGHTSMEN AND ENGINEER DESIGNERS required for traction control gear. Men having good mechanical experience would be considered. Good remuneration for men of first-class experience.—Apply, quoting "Switchgear," to Staff Manager, The General Electric Co. Ltd., Witton, Birmingham 6. (L 174)

DRAUGHTSMAN required with experience on design and development of metalclad switchgear up to 250mVA at 11kV. Also Contracts Draughtsman required, experienced on flat back and cubicle type switchgear, and able to do diagrams. Good salary offered for suitably qualified applicants. Pension scheme available.—Reply, stating age, salary and full details of technical qualifications, to Erskine, Heap and Co. Ltd., Lancashire Switchgear Works, Salford, Manchester 7. (L 351)

DRAUGHTSMEN, senior and junior, for the design of switch and control boards, also draughtsmen or design engineers, capable of compiling comprehensive diagrams for power station equipment. Good remuneration for experienced reliable men.—Apply, quoting "Switchgear," to Staff Manager, General Electric Co. Ltd., Witton, Birmingham 6. (L 349)

ELECTRICAL AND MECHANICAL ENGINEERS and metallurgists are required for experimental work at the Research Laboratories of The General Electric Co., Ltd., East Lane, North Wembley, Middlesex. Graduate staff are needed for work on radio-communications, domestic heating appliances, illumination, light mechanical engineering problems and in the metallurgical field.—Applications, giving age and record, should be sent to the Staff Manager (Ref. GBLC/429). (L 244)

ELECTRICAL AND MECHANICAL ENGINEERS AND PHYSICISTS are invited to apply for employment in the Illumination Group of the Research Laboratories of The General Electric Co., Ltd., East Lane, North Wembley, Middlesex. Candidates should be graduates or have equivalent qualifications and be interested in the practical work of a laboratory as well as more fundamental investigations. A commonsense approach to a wide range of electrical, mechanical, optical and thermal problems will be required but no experience of lighting is necessary. Previous training in a works may be an advantage.—Letters, giving details of age and record, should be sent to the Staff Manager (Ref. GBLC/513). (L 371)

ELECTRICAL DRAUGHTSMEN wanted for long-term oil refinery and chemical plant programme. Five-day week, pension and insurance plan.—Write, stating experience and salary required, to Chief Engineer, E. B. Badger and Sons (G.B.) Ltd., 40 Parkgate Road, Battersea, London S.W.11. (L 62)

ELECTRICAL ENGINEER required for electrical contractors on south coast, knowledge of shipwork advantageous.—Please write, giving details of age, qualifications and experience, to Box "C.O." c/o Geo. J. Smith and Co. Ltd., 74/76 Temple Chambers, Temple Avenue, London E.C.4. (L 344)

ELECTRICAL ENGINEER with 3-5 years post graduate experience is required for the design of special types of small motors and generators to form part of a complete electro-mechanised system. Applications, in writing, to be sent to the Staff Manager (Ref. GBLC/441), Research Laboratories of The General Electric Co., Ltd., East Lane, North Wembley, Middlesex, stating qualifications, age and experience. (L 258)

ELECTRICIAN, FOREMAN OR JUNIOR SUPERVISOR required for Melbourne, Australia, by an old-established and well-known London building and civil engineering contractors.

The applicant should preferably be of National Certificate standard with a thorough practical training. The immediate requirement is for a man to reliably carry out electrical installation of the company's new offices, bungalows, etc., in Melbourne, without electrical supervision, and subsequently to act as the company's electrician.

This is an unusual opportunity for the man with the right personality and energy to reach a high status with the company's development.

Applicants should, in the first instance, write, giving adequate particulars of age, training—both practical and technical, if married or single, and salary desired.

Passage to Australia and accommodation there will be provided and terms of remuneration will be based on the applicant's immediate competence for the job and potential development.

It is not possible at this stage to provide for family accommodation, but provisions for this are being developed as quickly as possible.—Reply Box No. 8035, Electrical Times. (L 366)

ESTABLISHED non-association cable manufacturer requires ENGINEER, competent to design super tension cable and supervise processing and testing. This senior position is permanent and pensionable and affords scope for development. Previous experience is essential. Applications should give full details of training and experience.—Box No. 8031, Electrical Times. (L 357)

FALCO ELECTRICAL APPLIANCES LTD. require the services of full time DEMONSTRATOR. Replies should give age, experience and salary required.—Corporation Road, Audenshaw, Manchester. (L 359)

FERRANTI LIMITED invite applications for senior appointments of Graduate Engineers with industrial experience in electrical measurements, particularly in electrical integrating energy metering, both industrial and commercial, together with knowledge of testing equipment and facilities. The posts to be filled carry senior responsibility with excellent prospects, generous salary and pension.—Application forms from Mr. R. J. Hebbert, Staff Manager, Ferranti Limited, Hollinwood, Lancs. Please quote reference M.E. (K 744)

FOR BRITISH COLUMBIA. Pacific Coast Canadian Pulp and Paper Mill requires experienced MAINTENANCE AND CONSTRUCTION ELECTRICIANS. Applicants should have knowledge of h.t., a.c. generation and distribution, a.c. and d.c. motors and control, hoists, cranes, elevators, transformers. Possession of ordinary National E.E. Certificate an advantage.

Apply, in writing, to James Bird, c/o Canadian Immigration Department, 18 Woodlands Terrace, Glasgow, Scotland. All applications will be sent forward to B.C. (L 336)

JOHNSON AND PHILLIPS LTD. have a vacancy for a TRANSFORMER DESIGNER experienced in dealing with all sizes up to 10 M.V.A. This is an attractive opening for a progressive man. Five-day week, staff pension and bonus scheme, good welfare facilities, sports club with private sports ground catering for cricket, tennis, Association and Rugby football. Work's canteen with licensed bar and equipped for billiards, table tennis, amateur dramatics, etc.—Applicants should state age, experience, training and salary required and be addressed to Employment and Welfare Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, London S.E.7. (L 289)

OPENINGS for two ELECTRICAL DRAUGHTSMEN between 45 and 50 years of age. West Midlands. Preferably experienced l.t. control gear, plant layouts and diagrams. Good pension scheme, canteen facilities, 5-day week with some overtime. State age (not exceeding 50), present salary and give references.—Box No. 8029, Electrical Times. (L 356)

SENIOR DESIGNER-DEVELOPMENT ENGINEER required by leading manufacturer of domestic and light industrial electro-mechanical control devices in West London. Only men of proved experience and success in most modern practice need apply. First-class opportunity for advancement.—Fullest particulars of qualifications, career to date and salary required in confidence, to Box No. 8011, Electrical Times. (L 302)

SKILLED ELECTRICIANS WANTED, with overhead electric crane and steelworks machinery experience, willing to travel.—Apply, Personnel Dept., The Wellman Smith Owen Engineering Corporation Ltd., Darlaston, South Staffs. (L 346)

SPLENDID opening. ASSISTANT required to director of electrical company. Age about 30. Must have similar position. Please send complete details of career. —Box No. 8045, Electrical Times. (L 389)

TRANSFORMER DRAUGHTSMEN for work on units within a range up to 10 MVA. Salaries in accordance with qualifications.—Apply Technical Director, Bryce Electric Construction Co., Ltd., Kelvin Works, Hackbridge, Surrey. (L 370)

APPOINTMENTS WANTED

ASSISTANT SALES MANAGER, A.M.I.E.E. Switchgear and associated equipment, desires change. Midland or Southern area preferred.—Box No. 7099, Electrical Times. (L 254)

ENGINEERING BUYER (28) with secretarial qualifications desires position where intelligence and initiative is appreciated—Box No. 8033, Electrical Times. (L 365)

EXPERIENCED CHIEF ENGINEER (40), A.M.I.E.E., with wide mechanical knowledge, covering works and production of motors, generators, switchgear, gearing, electronics; adaptable.—Box No. 8043, Electrical Times. (L 368)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed. Edgware 8631 (4 lines). —Service Electric Co. Ltd., Stanmore, Middx. (D 324)

ARMATURE SERVICE CO. LTD., Haddington Street, Hove (Tel.: 32996), electrical engineers and winding specialists. Distance no object. (F 739)

CASTINGS, Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham, Victoria 0197. (L 318)

HOME COUNTIES. More than 10,000 sq. ft of excellent floor space suitable for LIGHT ASSEMBLY WORK, such as the assembly of electrical components, etc.—Write Box No. 8025, Electrical Times. (L 343)

METALWORK. All types cabinets, chassis, racks, etc., to your own specifications.—Philpott's Metalworks Ltd., Chapman Street, Loughborough. (L 228)

MICA. Enquiries are invited for small details, segments, stampings, etc., to be made in mica, for which good stocks are available. Nickel tags for iron elements supplied in quantity. Also a quantity of brass and all available for us to execute your press and capstan work.—Enquiries to L. J. Crowson and Co., Ltd., 41 Loudoun Road, London N.W.8. Phone Maida Vale 1428. (L 372)

WANTED: DRILLING, WELDING, all types, heavy and light, also MACHINING, all kinds, reasonable screwing facilities.—Birchills Repair Depot, Walsall. Tel. 3793. (L 342)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installation, etc.—A.A. Electrical Co. Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 5105. (A 20)

BALL RACES WANTED. Large quantities required, surplus or redundant stocks. Wide range of sizes and types including ¼, ⅜, ½, ⅝, ⅞ and 1 in. 4, 5, 6, 7 and 9 mm. bore.—Offers to D. C. Woodberry, Treforest Trading Estate, Glam. (L 227)

GENERATORS, d.c., continuously rated between 3,000 and 5,000 amps. at 150/250 volts. Two required.—Box No. 8039, Electrical Times. (L 386)

ISENTHAL VOLTAGE REGULATORS WANTED. Any condition.—Box No. 7069, Electrical Times. (L 305)

STEEL, ALUMINIUM, BRASS. Sheets, Strip, Bars. Off-cuts. Any quantity—immediate payment.—Grades Sheared Metal Co. Ltd., Green Lane, Hounslow, Middx. Tel.: Feltham 3274. (L 77)

WANTED, SCRAP ELECTRIC MOTORS, DYNAMOS AND CABLE. Top prices paid.—H. Reed, 36 Bridge Street, Leatherhead, Surrey. (K 11)

WANTED, ROTARY CONVERTORS, any size.—Universal, 221 City Road, London E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED. Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling. —Apply, giving full details to Midland Iron and Hardware Co., Cradley Heath. (A 5)

WANTED. D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co. Ltd., 22-26 Britannia Walk, London N.1. (A 13)

400 500, 800 cycle ALTERNATORS OR MOTOR GENERATORS wanted. All ratings, voltages and makes. Any quantity.—Wilfio Products, 216/226 Gorbals Street, Glasgow C.5. Tel. South 2385. (L 369)

AGENCIES

ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts., require AGENTS (preferably with knowledge of commercial, industrial and street lighting fittings), who have established contacts with borough engineers and surveyors and British Electricity Authorities in the following counties: Dorset, Wiltshire, Devon, Somerset, Cornwall and Gloucester. Also, Kent, Sussex, Surrey and Hampshire. (L 313)

MANUFACTURERS' AGENTS ASSOCIATION, INC. (E.T.), 8 Bream's Buildings, London W.C.2, supplies free lists of Agents to Manufacturers seeking representation in important industrial centres. Membership available to established agents only. Particulars supplied. (A 7)

FOR SALE

DOMESTIC APPLIANCES

IMMERSION HEATERS, Grubb 4 kW. No purchase tax. All lengths, 16 in. to 36 in. Standard voltages. Provision for intermediate loadings. Fully guaranteed. Write for illustrated brochure, latest lists and trade terms to distributors.—John Owner and Co. Ltd., Springfield Road, Birmingham 13. Tel.: Spr. 2939. (C 392)

GENERATING PLANT

MOTOR ALTERNATOR SET (Brand New) cost £150 accept £100 or near offer. One 3½-h.p. 220V d.c. motor coupled on bedplate to 2kVA 220V, 50 cycle, single-phase alternator, speed 1,500 r.p.m. controlled to give correct frequency at all loads. Alternator self-regulating type. Complete with switchboard mounting switch fuse unit and D.A. starter for the motor. Voltmeter, ammeter, shunt regulator, switch fuses and all necessary wiring for the a.c. output.—Box No. 8001, Electrical Times. (L 273)

LIGHTING EQUIPMENT

FOR sale, J.A.P. 12-32 V LIGHTING SET, in good condition; also 12-V heavy duty Lorry Battery, little used.—Poole, Ballyfinogue, Killinick, Wexford. (L 358)

PURLEY CHOKES AND BALLASTS. Our 80w Tapped h.p.f. Ballast, with Starter Switch-holder incorporated, is proving itself the most popular unit. Suitable for most fittings. 57/6 each, subject.—F. W. Blanshard Ltd. (Dept. ET), Purley, Surrey. Uplands 4818/9. (E 343)

METERS

A.C/D.C.— QUARTERLY AND SLOT-METERS Guaranteed, sent on approval if desired.—Brent Electrical Co., 6 Holmdale Gardens, London N.W.4. (A 15)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Road, London E.C.1. (C 51)

METERS, a.c. and d.c., new and reconditioned, all types. Quarterly, single and three-phase, 3 and 4 wire, 2½ to 1,000 amps. Prepayment, single and double tariff, single, dual and triple coin, fixed and variable tariff, 2½ to 50 amps. M.D.I., Billiards Switches, Rent Collectors. Prices from 5/- carriage paid, guaranteed for ever, immediate delivery. Illustrated catalogue from The Electric Meter Company, Castor Road, Brixham. (K 678)

MOTORS & STARTERS

A. ELECTRICAL CO. FOR A.C./D.C. MOTORS, SWITCHGEAR, EXHAUST FANS, HOISTS, REDUCTION GEARS, new or reconditioned units.—Chiswick 5105, Fairlands 8279, 67 Rothschild Road, W.4. (A 19)

A.C. and D.C. MOTORS, all sizes, large stocks fully guaranteed.—Milo Engineering Works, Ltd., Milo Road, East Dulwich, S.E.22. (Forest Hill 2276-9). (A 10)

ELECTRIC MOTORS. Special purchase of unused electric motors made by ALPHA HARRIS to B.S.S.168. All standard industrial machines, enclosed ventilated, with endshield B/R bearings and standard shaft extension. Starters available. Immediate delivery. All covered by our 12 months' guarantee.

Qty.	*H.P.*	*Type*	*Voltage*	*Speed*
8	30	SR	400/440/3/50	1500
50	18	SR	400/440/3/50	1500
60	10	SR	400/440/3/50	1500
45	7½	SR	400/440/3/50	1500
5	25	SC	400/440/3/50	1500
15	20	SC	400/440/3/50	1500
26	15	SC	400/440/3/50	1500
4	12½	SC	400/440/3/50	1500
30	5	SC	400/440/3/50	1500
50	4¼	SC	400/440/3/50	1500
4	3	SC	400/440/3/50	1500
50	2	SC	400/440/3/50	1500
6	1	SC	400/440/3/50	1500
47	2	Split ph.	230	1500
26	1	Split ph.	1/50	1500
42	15	DC	220	1300
46	7½	DC	220	1500
50	5	DC	220	1500
34	15	DC	110	1400
76	12	DC	110	1350
16	9	DC	110	1200
16	7½	DC	110	1200
7	6	DC	110	1450
14	6	DC	110	1260
10	5	DC	110	1450
14	5	DC	110	1260

George Cohen, Sons & Co., Ltd., Wood Lane, London, W.12. Tel.: Shepherds Bush 2070; and Stanningley, Nr. Leeds. Tel.: Pudsey 2241. (L 292)

ELECTRIC MOTORS, GENERATORS, TRANSFORMERS A.C. & D.C.

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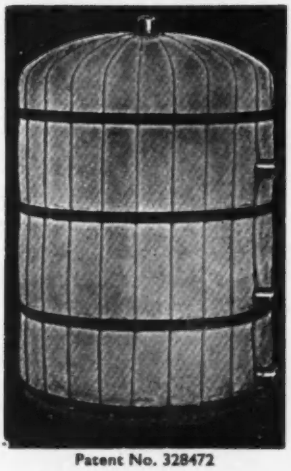

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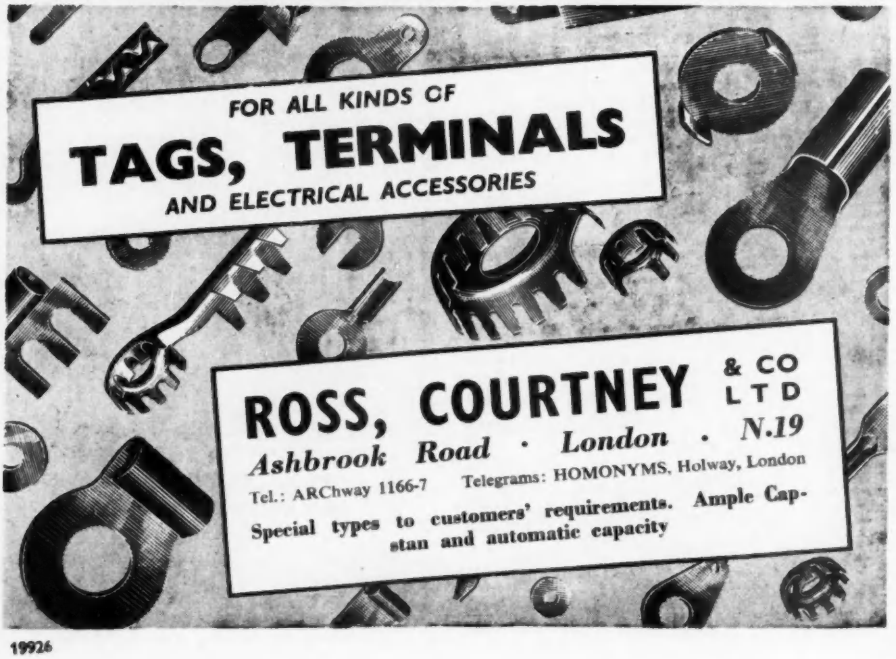
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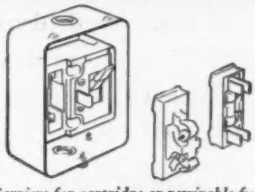

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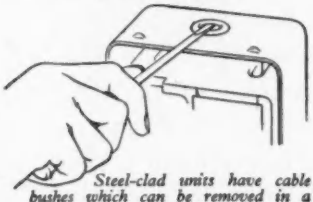

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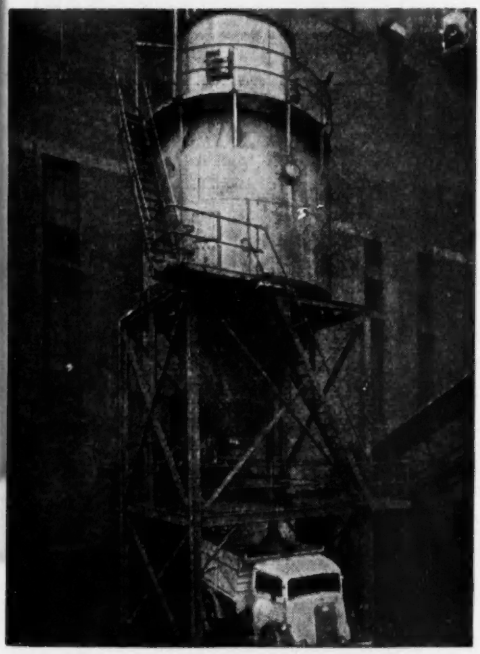

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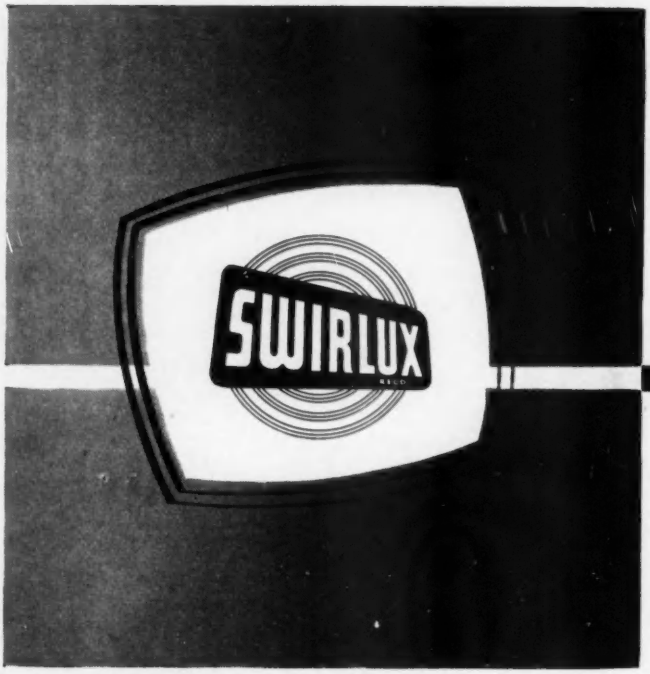

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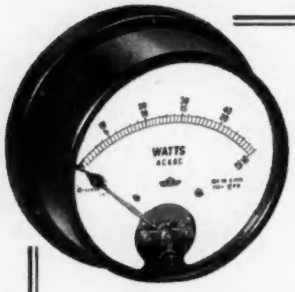

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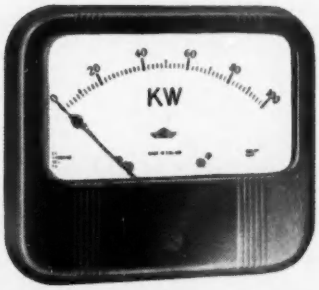

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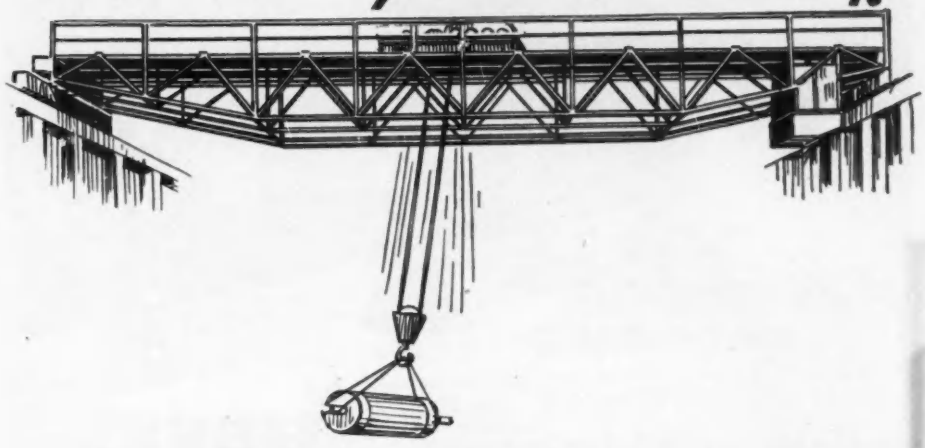

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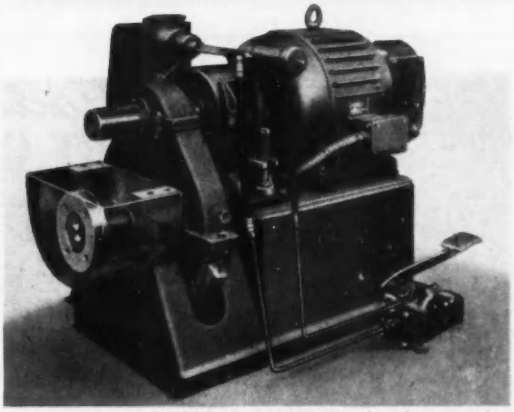

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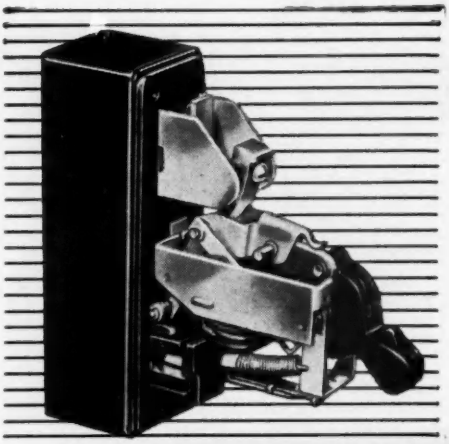

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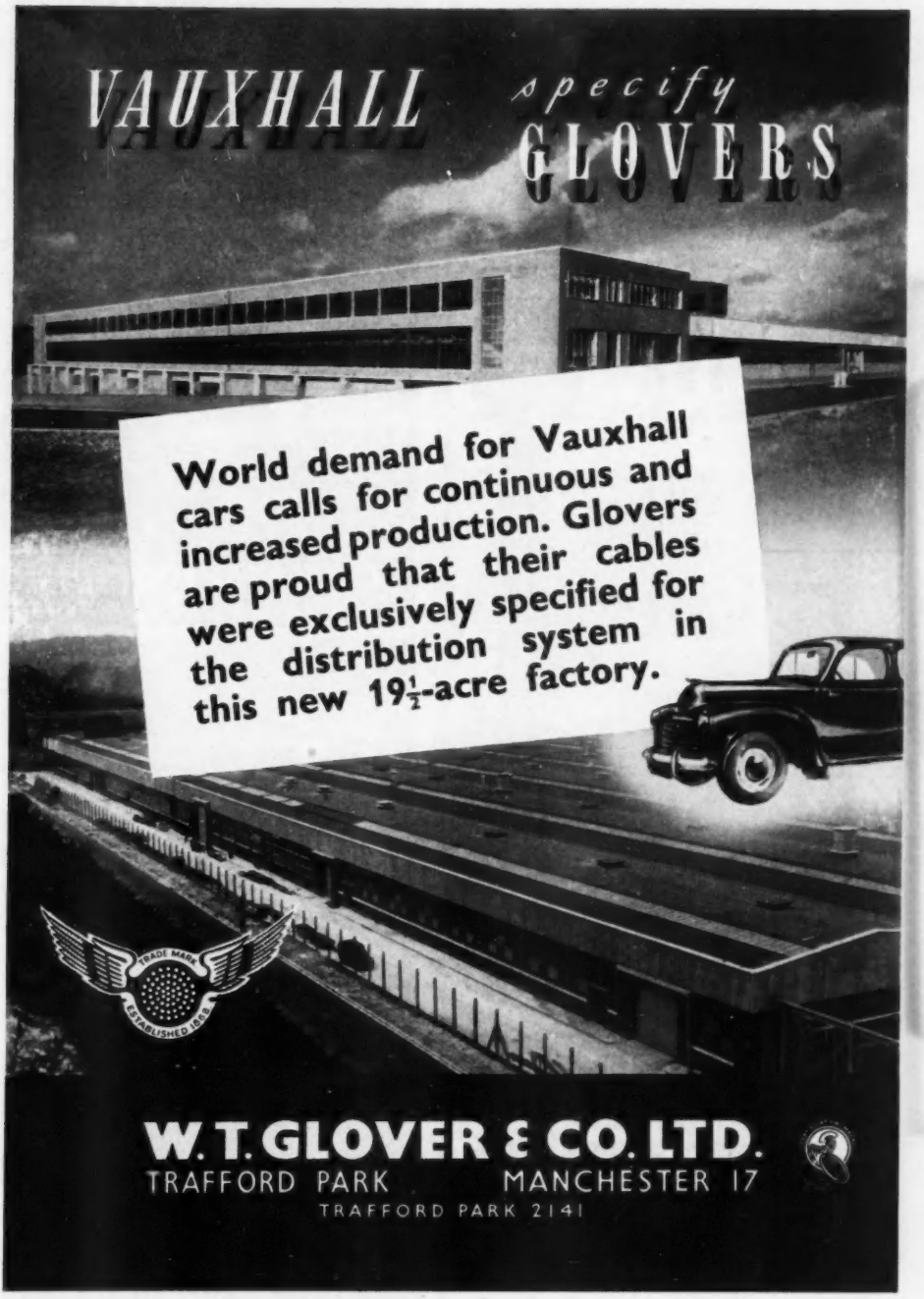
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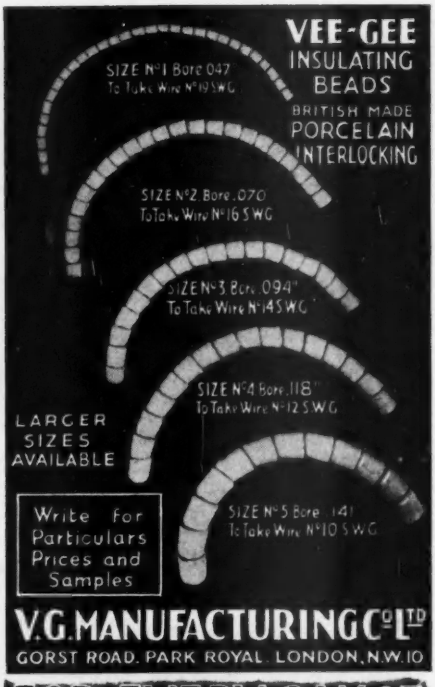
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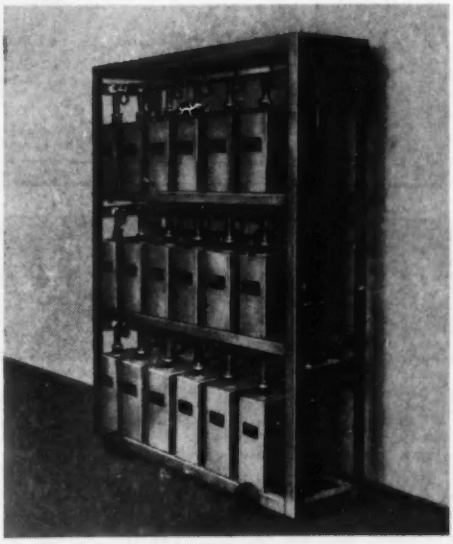

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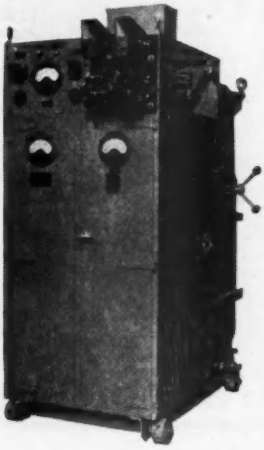

A typical DAVENSET Mercury Arc Rectifier with air-cooled transformer mounted behind cubicle

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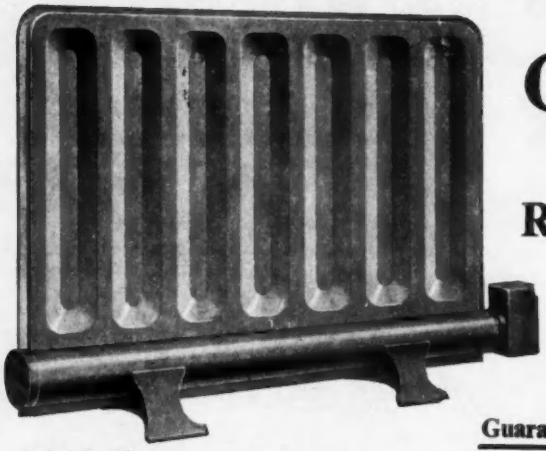

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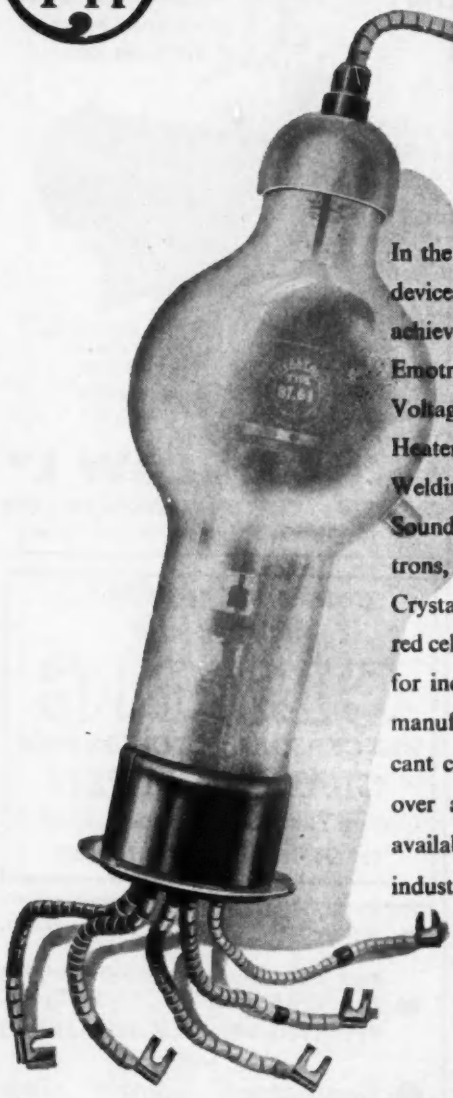

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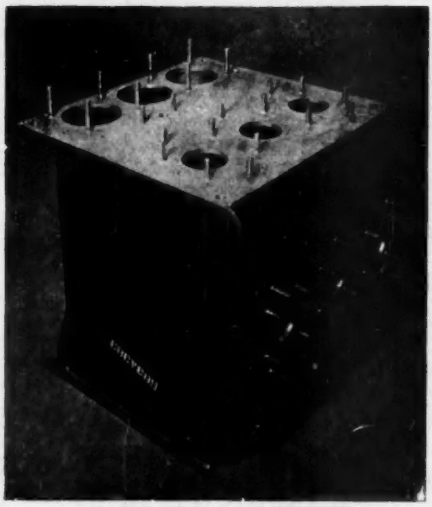

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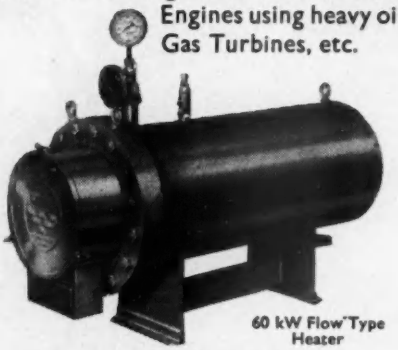

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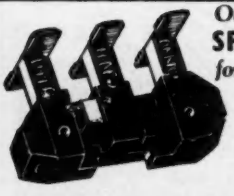

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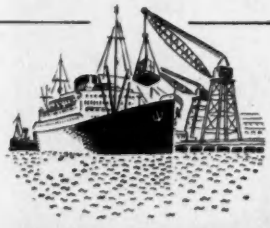

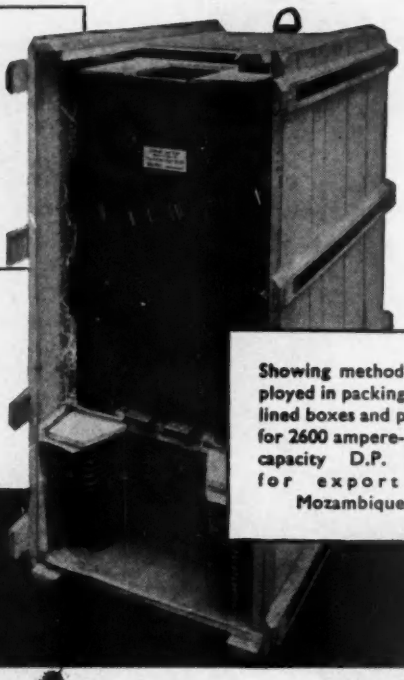

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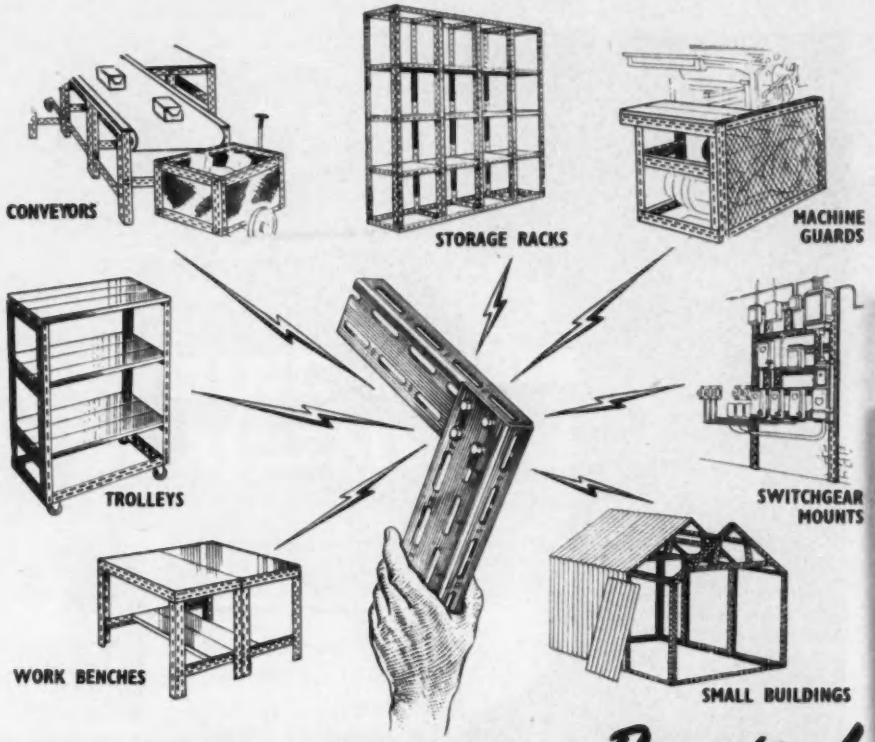

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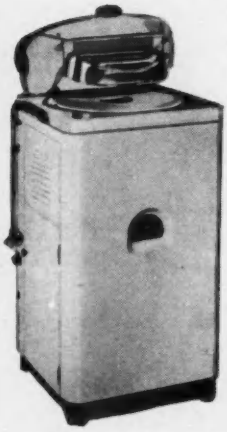

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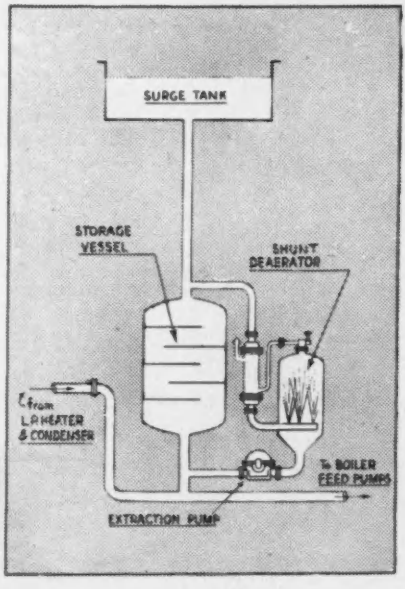

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